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ROTIFERA FROM AUSTRALIAN INLAND WATERS. IX. GASTROPODIDAE, SYNCHAETIDAE, ASPLANCHNIDAE (ROTIFERA: MONOGONONTA)

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Summary

SHIEL, R. J. & KOSTE, W. (1993) Rotifera from Australian inland waters IX. Gastropodidae, Synchaetidae, Asplanchnidae (Rotifera: Monogononta) *Trans. R. Soc. S. Aust.* **117**(3), 111–139, 30 November, 1993.

A brief history of this 12 part series of papers on the Australian Rotifera is given. Of 28 rotifer families, the Australian species of 14 families were revised in the first eight parts. In this part, keys are given to the genera and species of three further families: Gastropodidae (*Gastropus*, three spp.; *Ascomorpha*, three spp), Synchaetidae (*Synchaeta*, ten spp.; *Polyarthra* six spp.; *Ploesoma*, two spp.) and Asplanchnidae (*Asplanchnopus*, two spp.; *Asplanchna*, seven spp.) all of which are planktonic in Australian inland waters. A new species of *Synchaeta* is described from the Fitzroy R., Queensland. All species of these genera recorded from Australian waters are described and figured with known distribution data and ecological information.

KEY WORDS: Rotifera, Monogononta, Gastropodidae, Synchaetidae, *Synchaeta* sp.nov., Asplanchnidae, Australia, descriptions, keys, trophi, biogeography.

Introduction

An earlier paper (Shiel & Koste 1979) collated the known records of Australian Rotifera from a widely scattered literature. At that time, 331 taxa were recognized from inland waters of the continent. Thereafter we proposed to accumulate additional records for publication as short checklists, with descriptions of new taxa as they occurred (e.g. Koste & Shiel 1980). Our own samples accrued, and widely separated colleagues sent material from various parts of the mainland and Tasmania. Many of the rotifers we found could not be identified from the keys of Kutikova (1970) or Koste (1978a), the recognized authorities. Rotifers generally were considered cosmopolitan at that time, however, our samples indicated that the Australian rotifer fauna contained a distinct indigenous component. Taxonomic keys to them simply were not available, so to provide such keys became our aim.

The probable audience for a taxonomic volume on Australian rotifers comparable to the revision by Koste (1978a) was considered too small to bear the production cost. Further, WK had taken some 12 years to complete the European revision, and the prospect of another 12 on the Australian fauna was daunting. A series of smaller "manageable" papers seemed to be appropriate to put keys to species in the hands of the scattered collectors. We therefore started to draft keys to the common planktonic species in May 1984 (WK was then 72), working by family or groups of families.

The Editor of the CSIRO journals was approached, and agreed to take the first manuscript, on bdelloid rotifers occasionally found in plankton. This was published in *The Australian Journal of Marine and Freshwater Research* (Koste & Shiel 1986). The following year, the second paper of the series (the monogonont families Epiphanidae and Brachionidae) was published in a new CSIRO journal, *Invertebrate Taxonomy* (Koste & Shiel 1987a). Then followed a hiatus when papers III and IV were "lost" in the system in 1987-88 and subsequently withdrawn, without rancour, from *Invert. Taxon.* To keep the series in Australia we approached the Editor of the *Transactions of the Royal Society of South Australia*, were accepted, and saw the Euchlanidae, Mytilinidae, Trichotriidae and Colurellidae appear in 1989 (Koste & Shiel 1989a, b). Subsequently, Lecanidae, Proalidae and Lindiidae (Koste & Shiel 1990a, b), Notommatidae (Koste & Shiel 1991) and Trichocercidae (Shiel & Koste 1992) have continued the series.

In the interim, the contents were expanded to include all known Australian rotifers, not only pelagic taxa. The littoral taxa are considerably more diverse, and determining whether some of them were in fact what they were named has been a slow process. The need for a complete global revision of rotifer systematics compounded our difficulties. We apologize for the rate-decrease, but plead that demands on both of us are greater as more researchers become interested in the Rotifera, and seek assistance. WK bears the weight of the global community of rotifer workers; RJS has only Australasia to deal with, hence has taken over production of the series, and is responsible for errors or omissions which may sneak through.

So, for those avid readers who have agitated for keys to the families yet to appear, the end is in sight! Three further families are reviewed in this part (Gastropodidae, Synchaetidae, Asplanchnidae). Two remaining ploimate families (Dicranophoridae, Microcodinidae,

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32 spp., part X) should be completed early in 1994, and the eight families of Flosculariacea (73 spp., part XI) and Collothecacea (16 spp., part XII) during 1994. By this time a global systematic revision now in preparation should be available, and the confused status of some of the taxa in our earlier parts be resolved (see also Biogeography section later). The first and introductory volume has been published (Nogrady *et al.* 1993) and the systematic sections will be published in parts by family. For recent research on rotifers, see also Gilbert *et al.* (1993).

The three families reviewed here contain about 33 species, all more or less exclusively pelagic in habit. They are less diverse than other common pelagic families, e.g. Brachionidae or Trichocercidae, both with >45 taxa recorded (Koste & Shiel 1987a; Shiel & Koste 1992), but species of Gastropodidae and Synchaetidae appear to be numerically the most common planktors in Australian inland waters. Species from the three families occur in virtually any standing freshwaters, where they may reach very high densities, e.g. in Nov. 1981 >24,000 *Synchaeta* spp. l^{-1} occurred in Mt Bold Reservoir, S.A. (Shiel *et al.* 1987). This represents a significant biomass, even though individual animals are small (most < 200 μm). The same study reported sequential *Synchaeta* species replacements (five taxa) in the filling Dartmouth Reservoir (1978-80), but otherwise rotifer limnoplankton composition and community succession is poorly documented in Australia.

Billabongs in particular may support a diverse assemblage of species at any time, with two or more taxa from each family co-occurring. Temporal succession in response to seasonal changes in physico-chemical and biological conditions may be very rapid, e.g. in a billabong near Wodonga, species dominants changed within days in an autumn series of daily plankton samples (Tan & Shiel 1993). In the gastropodids and synchaetids, high population densities, combined with specialized feeding habits, produce profound grazing effects on preferred bacterial/algal populations. In contrast, asplanchnids do not reach such high densities, but may be significant predators in their aquatic food webs, taking other rotifers and microcrustaceans. Species of *Asplanchna* may be the largest predatory zooplankters (>2500 μm) in some habitats. Details of feeding preferences are given in the systematic section.

We stress that it is very likely that undescribed taxa of these rotifer families occur in Australia. More than 50% of the species in some of the genera we have reviewed to date are indigenous, yet only a single asplanchnid and a single synchaetid described here apparently are endemic. While this disparity may be real, it also may reflect a poor level of taxonomic discrimination in earlier studies, i.e. a tendency to 'shoehorn' taxa into the nearest described species. The forthcoming global revision will resolve many of the extant anomalies. For a critique of some problems pertaining to Australian microfauna see Green & Shiel (1992).

In this review the format of earlier parts is followed; for convenience, genera and species are treated alphabetically. Keys to rotifer families are included in Koste & Shiel (1987a), which also contains brief descriptions of general morphology. A family level key in Wallace & Snell (1991) also may be useful. Known distribution and ecological information are given for the species we have encountered. Global distribution and ecology is given in Koste (1978a). Type material generally was not designated in many early studies, nor type localities given. We have included type locality if it is known, otherwise probable place of origin is given in parentheses. Some early authors did not specify origin of material, however we consider it likely that in the late 18th-early 19th century their collections derived from reasonably close to home.

Methods

In living material, the rotifers reviewed here are placed readily into their appropriate families and genera by their characteristic body morphology (Fig. 1). Gastropodidae (*Ascomorpha*, *Gastropus*) (Fig 1:1, 1:2) are ovate-globular with firm cuticular loricae, and distinctive dark 'defaecation vesicles' or coloured chromatophores in the stomach wall. Synchaetidae (*Synchaeta*, *Polyarthra*, *Ploesoma*) (Fig 1:3, 1:4, 1:5) are more varied; *Synchaeta* species are illoricate, pyriform or conical with distinctive anterolateral ciliated auricles (Fig. 1:3a). *Polyarthra* species are small cubes with dorsolateral and dorsoventral foliate appendages (Fig. 1:4a); *Ploesoma* is firmly loricate, with distinctive delineation of the lorica, and relatively large foot (Fig. 1:5a). Asplanchnids (*Asplanchnopus*, *Asplanchna*) are large saccate forms (to 2.5 mm) with large pincer-like incudate trophi. Asplanchnids are superficially similar to, and likely to be confused with large saccate epiphanids (*Epiphanes*) (cf. Koste & Shiel 1987a), with which they may co-occur.

Preservation in alcohol, formalin, gluteraldehyde, etc., induces strong contraction of illoricate saccate forms, or retraction of anterolateral auricles in synchaetids. Resolution of species in the case of strongly contracted animals requires clearing in hypochlorite (NaOCl) and examination of the sclerotized mastax elements – the **trophus**. Trophi are generically distinctive; indeed, evidence to date suggests that they are species specific. Specific determination is more difficult for those taxa with small membraneous trophi, e.g. synchaetids, than for taxa with large heavily sclerotized trophi, e.g. asplanchnids. The difficulty of identifying preserved *Synchaeta* spp., for example, was discussed by Ruttner-Kolisko (1974). Details of trophi preparation for light- and electron

microscopy are given in Koste & Shiel (1989c) and Sanoamuang & McKenzie (1993). Particular care must be taken with *Synchaeta* and *Polyarthra* species, with prolonged immersion, NaOCl is likely to erode delicate trophi. Rapid replacement of NaOCl with non-corrosive mountant (e.g. 10% glycerol-H_2O) is necessary.

A useful pictorial method has resulted from developments in computer software and videography. High resolution 'videographs' approaching light-micrograph quality can be achieved electronically for reasonable cost. The advantages include immediacy, electronic storage, and ability to print black and white or coloured images on a range of laser- or video printers. Several of the photographs in this part were printed using a Sony CVP-G700 printer via a microscope-mounted Sony DXC-107AP video camera. Electronic images also may be captured by a frame-grabber and printed via a laser printer. The resolution on a 600 dpi printer approaches black and white photograph quality. The main advantage here is immediacy. Samples received for identification can be checked, and some or all taxa "grabbed" onto disk storage. An electronic reference collection can be built up, disks can be exchanged much more readily than bottle samples, and printed images can be returned to collectors for the cost of a photocopy.

Systematic section

Rotifer classification has been based largely on morphology, and only in the past decade or so have there been advances in comparative biochemical and ultrastructural methods, e.g. electrophoresis, restriction fragment polymorphism, polymerase chain reactions, SEM, TEM (Koste & Shiel 1989c; Nogrady *et al.* 1993).

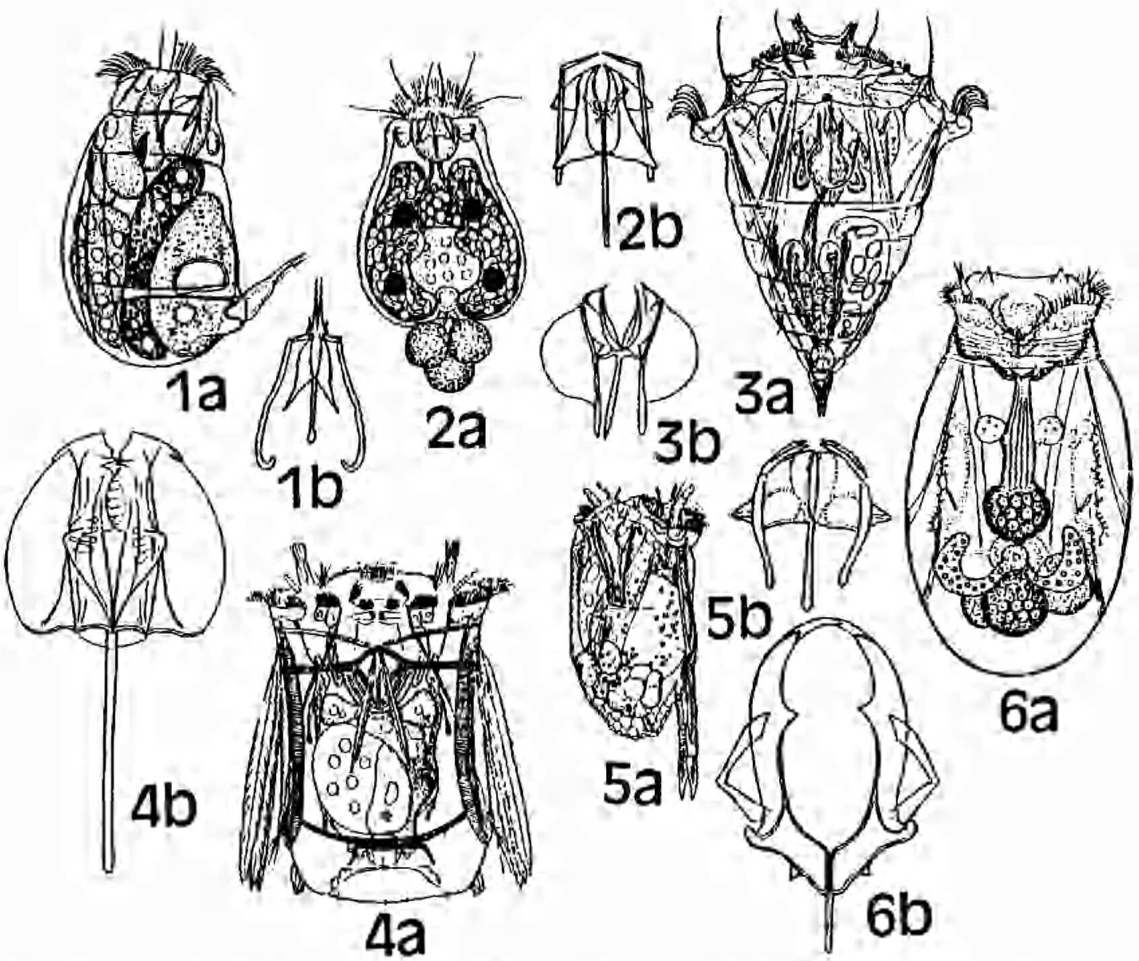


Fig. 1. Habit (a) and trophus morphology (b) of: 1, *Gastropus*; 2, *Ascomorpha*; 3, *Synchaeta*; 4, *Polyarthra*; 5, *Ploesoma*; 6, *Asplanchna*. After Koste (1978a).

These methods will resolve some of the problems observed with morphological criteria, but they are not readily available to the majority of workers. While there are still few workers globally with the necessary expertise, morphology will continue to be the principle classification tool.

The classification followed here is that detailed in Koste & Shiel (1987a) based on the revision by Koste (1978a). This also is the classification used by Wallace & Snell (1991) and Nogrady *et al.* (1993), except that both these works follow the American practice of regarding the Rotifera as a Phylum rather than a Class of the Phylum Aschelminthes. A new classification system based solely on trophi structure has been proposed by Markevich (1990). If ultimately accepted as better than the classical system, it will not affect the specific, generic or familial placement of the Australian rotifer fauna, but will change the placement above family.

Taxonomic descriptions of all the species treated here are after the revision of Koste (1978a). Some taxa have additional descriptive material from the original authors where we felt it was needed. In some cases further description has been added from the Australian material where we were confident that the taxon was the same as the nominate species, but for which the original description was inadequate by modern standards. In some cases the original description lacked figures, trophus details, etc. We have tried to provide figures of general morphology, and to include trophi where possible, but the process is fraught with difficulty when there is doubt that the Australia taxon is the nominate species. In such cases we have included a comment.

Abbreviations for morphometric measurements: BH=body height; BL=body length; BH=body width; FT=foot; F=fin; FL=fin length; FU=fulcrum; FW=fin width; M=manubrium; ME= male egg; R=ramus; RE=resting egg; SE=subitaneous egg; T=toe length; TR=trophi length; TL=total length; U=uncus. All measurements refer to adult females unless otherwise noted.

Family Gastropodidae Remane, 1933

Gastropodids are small, usually highly coloured rotifers common in inland waters Australia-wide. They are characteristically fast swimmers, abundant in spring in the pelagic of reservoirs and billabongs, also in slow reaches of rivers (Shiel *et al.* 1982; Kobayashi & Shiel, in press). Two genera, *Gastropus*, with three spp. known and *Ascomorpha*, with six spp. known globally (Koste 1978a). Three species of each have been recorded from Australia. It is not unusual to find more than one species of each genus co-occurring. In this event there is often a size difference in the congeners, apparently to utilize different resources. Features: rarely semiplanktonic; oval, saccate or flask-shaped; laterally flattened; foot present *(Gastropus)* or absent *(Ascomorpha)*; apical field has tentacles in some species; mastax virgate, in *Gastropus* with prepharyngeal cuticular tube; stomach lobed or with blind sacs.

Key to genera

1. Foot absent, 1-4 dark brown to black defaecation (=accretion) vesicles ..... *Ascomorpha* Perty
   Foot present, one or two toes, no dark vesicles ..... *Gastropus* Imhof

Ascomorpha Perty

Ascomorpha Perty 1850: 18.

Type: Ascomorpha ecaudis Perty 1850, p.18.

Body saccate or ovoid, may be dorso-ventrally compressed, lacks foot; cuticle thin, lightly stiffened or with dorsal and ventral plate *(A. ovalis)*; apical field with membranelles, ciliary bundles, styli, palpar organs, fingerlike tentacle used for holding prey cells; trophi virgate; unci thin, stiletto-like; rami long, acute, elongate, right-angled dorsally (straight in *A. ovalis*); stomach large (lobed or blind sacs), filling almost entire body; intestine, cloaca and anus absent, wastes stored in 1-4 defaecation or accretion vesicles; large protonephridial bladder present; one cerebral eyespot, displaced to left in *A. ecaudis* and *A. saltans*; dorsal and lateral antennae very small, difficult to see.

Ascomorpha species feed by sucking chromatophores and cell contents from algal cells, or ingesting whole cells. These may be incorporated into the stomach wall, where they may survive and divide, before being digested.

Key to species of *Ascomorpha* Perty known from Australia

1. Corona with finger-like palpar organ (Fig. 2a, 3a) 2
   Palpar organ absent (Fig. 1a) ..... *A. ecaudis* Perty
2. Lorica with distinct dorsal and ventral plate ..... *A. ovalis* (Bergendal)
   Stiffened cuticle may have striae, but no distinct plates ..... *A. saltans* Bartsch

Ascomorpha ecaudis Perty
FIG. 2:1

Ascomorpha ecaudis Perty, 1850, p. 18.
Sacculus viridis Gosse, 1851, p. 158.

Type locality: (Switzerland).

Description: Saccate body widest in distal third; cuticle not striated; apical field with ciliary tufts and elongate styli; stomach lobulate with yellow/green/brown contents; four lobes with dark defaecation vesicles, darker in older animals; vitellarium with eight nuclei. Trophi: rami acute, elongate, with triangular alulae (Fig. 2:1b); manubria well developed, fenestrated, terminally straight or slightly curved; 1-2 SE carried attached to cloacal opening; RE spinulate.

TL 130-200 μm; TR 35 μm (FU 17; R 18; M 14)
Distribution: Perennial in plankton of ponds and lakes, often with spring/autumn peaks. Probably pancontinental, but not yet recorded from W.A. Abundant in R. Murray billabongs, also in lower R. Murray plankton in summer (Shiel *et al.* 1982): 8.0-29.8 °C, pH 4.3-7.8, DO 5.8-11.2 mg l^{-1}, 16-551 μS cm^{-1}, 6.8-40.0 NTU, alk. 1.9 mg l^{-1}, TDS 24.9 ppm.

Ascomorpha ovalis (Bergendal)
FIG. 2:2

Anapus ovalis Bergendal, 1892, p. 1.
Ascomorpha ovalis: Carlin 1943, p. 34.

Type locality: (Greenland).
Description: Lorica consists of distinct dorsal and ventral oval plates covered with thin membrane (Fig.

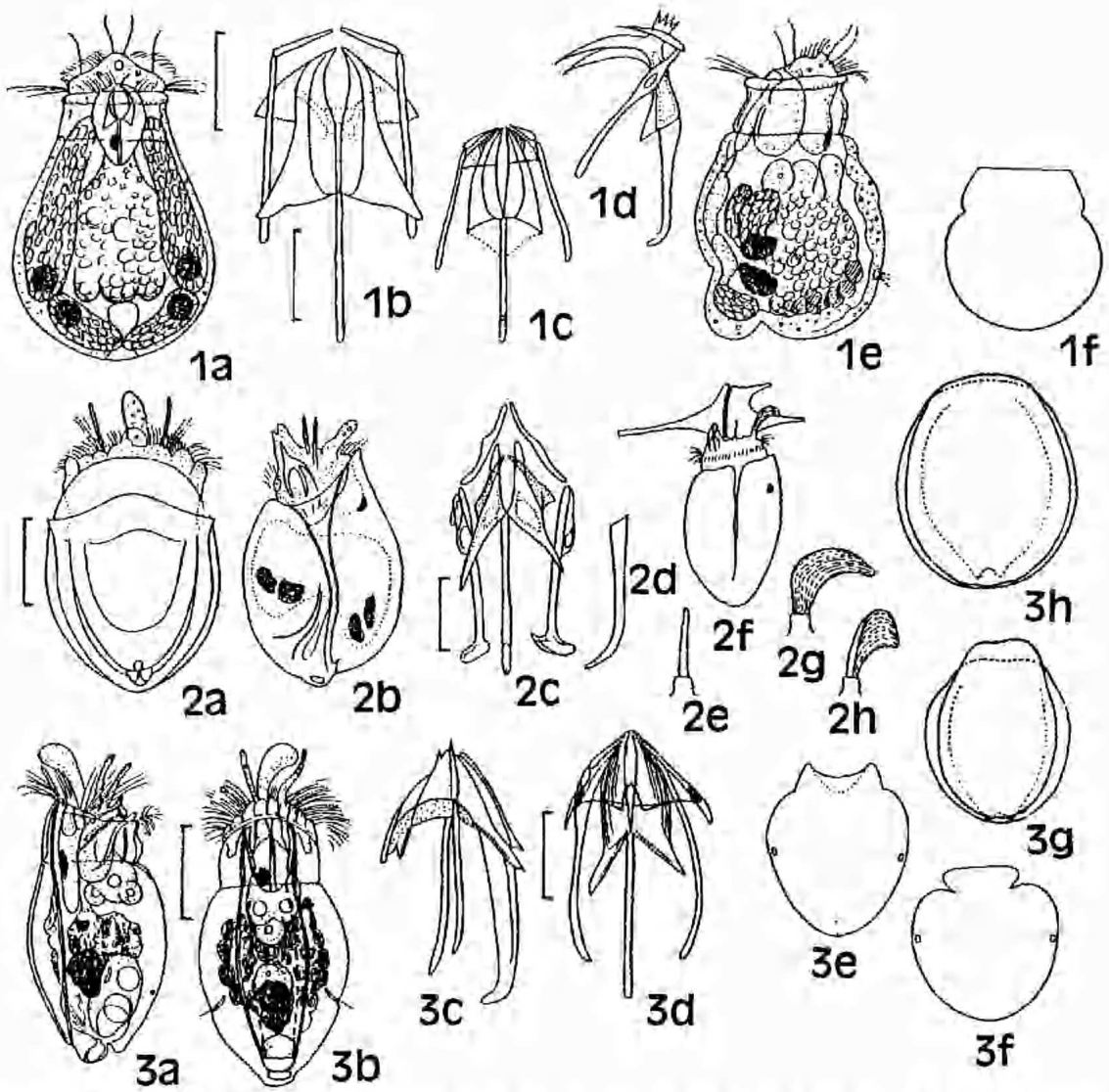


Fig. 2. 1, *Ascomorpha ecaudis* Perty: (a) ventral; (b,c) trophus; (d) trophus, lateral; (e) lateral; (f) body section. 2, *A. ovalis* (Bergendal): (a) ventral; (b) lateral; (c) trophus; (d) fulcrum, lateral; (e) sensilla; (f) using tentacle to hold *Ceratium*; (g,h) tentacle or palpar organ. 3, *A. saltans* Bartsch: (a) lateral; (b) dorsal; (c) trophus, lateral; (d) trophus; (e,f) body sections; (g,h) morphs from different populations. 1f after Donner (1943), (1a-e, 2, 3 after Wulfert (1960). Scale bars: adults 50 μm, trophi 10 μm.

2:2a, b), apical field with single main tentacle and smaller accessory palpar organ; median red cerebral eye; dorsal antenna small, lateral antenna not reported. Trophi of simple structure: rami occasionally asymmetric, with long alulae; two suprarami above them; unci long, thin rods; manubria distally double-crooked (Fig. 2:2c); stomach with four blind sacs, wastes accumulate as dark irregular balls (generally four); RE spherical, covered with small 'warts'.

TL 100-200 μm; male 70-80 μm, TR 35 μm (FU 20, M 20, U 14); RE 64×60 μm; MF 44×40 μm.

Distribution: Common in plankton, particularly during *Peridinium* or *Ceratium* blooms. *A. ovalis* grasps dinoflagellate cells with its tentacle (Fig. 2:2f), bores through the cell wall with the unci, and uses the mastax as a pump to suck out the cell contents. Chromatophores are digested intracellularly in the stomach wall, which is brownish-yellow as a consequence. Known from N.S.W., N.T., Qld, Tas. & Vic. 14.0-26.0 °C, pH 6.2-7.8, DO 8-9.4 mg l^{-1}, 35-190 μS cm^{-1}, 1-120 NTU.

Ascomorpha saltans Bartsch
FIG. 2:3

Ascomorpha saltans Bartsch, 1870, p. 364.

Type locality: 'bei Tübingen', Germany.

Description: Body oval, cuticle stiffened; dorsum with raised, flattened central section between parallel grooves (Fig. 2:3g); head with many folds in contracted individual; apical tentacle commonly deflected dorsally, with two adjacent unusually long stylii (Fig. 2:3a, b); two bundles of stiff bristles form fine tubes each side of mouth; mastax with 2-3 salivary glands; stomach not lobulate; gastric glands not described. Trophi: rami with alulae and domed suprarami; manubria rod-shaped; fulcrum curved dorsally at distal end. Ganglion with red eyespot (displaced to left); elongated retrocerebral sac behind ganglion; protonephridia with ca. 3 flame cells; SE and RE smooth; male undescribed.

TL 100-165 μm; BW to 85 μm; height to 88 μm; TR 28-34 μm.

Distribution: ?Pancontinental, not yet recorded from S.A. Summer occurrence in Murray-Darling reservoirs, e.g. L. Burrinjuck. 12.0-27.0 °C, pH 5.4-7.6, DO 5.8-8.0 mg l^{-1}, 59-1900 μS cm^{-1}, 1-10 NTU.

Comment: A single record of *A. saltans indica* from L. Barracoota, Vic. (Berzins 1982) is unverified. Smaller than the typical form (63-68 μm in contracted individuals), this Indian form has no appreciable trophi differences from *A. saltans* and is here considered an ecotypic variant.

Gastropus Imhof
Gastropus Imhof, 1891, p. 37.

Body laterally compressed; cuticle stiffened; anterior margin undulate; corona a simple band of cilia, may have palps and ciliary bundles within the paracingulum; hypodermis thickened, may have secretory function, e.g. gelatinous sheath in *G. stylifer*; dorsal antenna displaced caudally; lateral antennae asymmetric, difficult to see; mastax with prepharyngeal tube (Fig. 3b, c); trophi virgate; rami stiletto-like or with multi-toothed forked apices; stomach saccate, contains oil droplets and coloured dietary items; as in *Ascomorpha*, cells of stomach wall coloured green or brown by intracellular ingested chromatophores; rectum reduced; anus barely visible, probably non-functional; vitellarium with 8-24 nuclei; foot distinctly annulated, inserted ventrally; single fused toe or two short acute toes. Males with rudimentary digestive tract, evertible penis, relatively large brain with conspicuous cerebral eye. Finely spinulate eggs are attached to pelagic algae. RE with short spines on outer shell. All three described species are recorded from Australia. All are herbivorous. Their trophi pierce algal cells, particularly phytoflagellates. The mastax acts as suction pump through the prepharyngeal tube.

Key to species of Gastropus

1. Foot posteroventral with two toes ..*G. stylifer* Imhof
   Foot mediiventral with single toe 2
2(1). Anterior elongated (Fig. 2a); occipital margin undulating ..... *G. minor* (Rousselet)
   Head not elongated, occipital margin smooth ..... *G. hyptopus* (Ehrenberg)

Gastropus hyptopus (Ehrenberg)
FIG. 3:1

Notommata hyptopus Ehrenberg, 1838, p. 426, Fig. 50:6.
Gastropus hyptopus: Weber, 1898, p. 752.

Type locality: 'Bei Berlin', Germany.

Description: Body transparent, anterior cuticle stiffened, not tapered and elongated, with longitudinal furrows; dorsally a short keel; foot short, 2-segmented in adults; stomach with large oil droplets, contents mostly yellowish; brain with large dorsal cerebral eye; vitellarium with many nuclei. Trophi: rami apices with five prongs (Fig. 3:1e); large semicircular alulae on inner margin of manubria; males known; RE spiny (Fig. 3:1g).

TL 150-363 μm; T 25-30 μm; male 60-90 μm; TR 30-37 μm (FU 14 μm, M 15 μm).

Distribution: Widely distributed in eastern Australia, from Qld to Tas., generally in smaller waters, e.g. billabongs or stock dams. Apparently a wider thermal tolerance here than in Europe, where it is reported as a winter form. 8.0-23.5 °C, DO 4.1-10.8 mg l^{-1}, pH 4.4-7.1, 17-240 μS cm^{-1}, 5-120 NTU.

Literature: Evans (1951), Green (1981), Russell (1961).

Gastropus minor (Rousselet)
FIG. 3:2

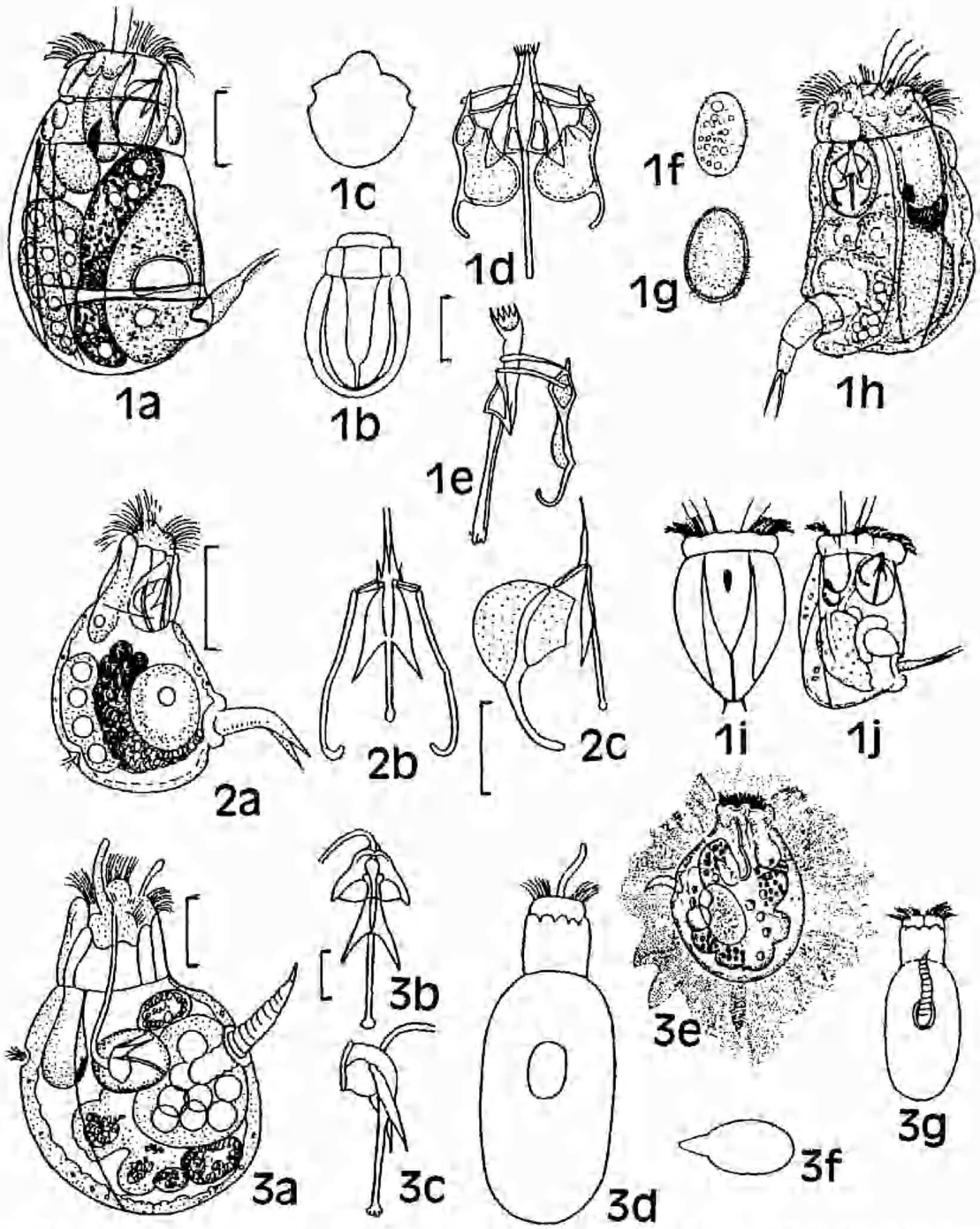


Fig. 3. 1, *Gastropus hyptopus* (Ehrenberg): (a) lateral: (b) lorica with striae: (c) body section: (d) trophus: (e) trophus, lateral: (f) male egg: (g) resting egg: (h) another individual, lateral: (i,j) dorsal and lateral views from another population. 2, *G. minor* (Rousselet): (a) lateral: (b) trophus: (c) trophus, lateral. 3, *G. stylifer* (Imhof): (a) lateral: (b) trophus: (c) trophus, lateral: (d) ventral: (e) animal in gelatinous sheath; (f) body section; (g) ventral with foot extended. 1a-e, h, 2, 3 after Wulfert (1960). 1f, g after Nipkow (1961). Scale bars: adults 50 μm, trophi 10 μm.

Notops minor Rousselet, 1892, p. 359, Fig. 24:9-10.
Gastropus minor: Weber 1898, p. 752.

Type locality: (Europe).
Description: Head tapered, elongate; foot smooth, slightly elongated. Trophi: needle-like rami can be protruded through mouth (Fig. 3:2b); long pointed alulae, almost symmetrical, at rami bases; single unci; manubria bilaterally lamellate (asymmetrical), with sweeping curve to distal crook; fulcrum rodlike. Animal generally colourless, although stomach contents may be brown and contain oil droplets; 4-8 nuclei in vitellarium.

BL 82-140 μm; FT 35 μm; T 20-23 μm; TR 24-30 μm.
Distribution: Known from Qld, N.S.W., N.T., Tas. in small lentic waters, with a single record from the Hopkins R. estuary, Vic.: 8.0-22.0 °C, pH 4.9-7.7, 14-60 μS cm^{-1}, <10 NTU.
Literature: Shiel & Koste (1979), Koste (1981).

Gastropus stylifer Imhof
FIG. 3:3

Gastropus stylifer Imhof, 1891, p. 37.
See Koste (1978a) for extensive synonymy.

Type locality: Black Forest, Germany.
Description: Notably brightly coloured; hypodermis blue, body fluid pink; gut contents green/brown; red cerebral eye; occipital margin undulate; with longitudinal striae; raised keel in cross-section; vitellarium with 6-8 nuclei. Trophi: thin, long fulcrum; rami with long pointed alulae; manubria and unci apparently fused into a cup-shape (Fig. 3:3b); long curved prepharyngeal tube present; SE almost smooth; RE warty.

TL 220-250 μm; W 56-70 μm; FT 40 μm; SE 60×40 μm; RE 60×44 μm; male 80 μm; newly-hatched juveniles 75-100 μm.
Distribution: Lays eggs in colonial phytoflagellates *(Dinobryon, Uroglena);* feeds on *Peridinium* and other Dynophyceae, sucking out contents (Koste 1978). Most common species of the genus in our collections, occasionally co-occurring with *G. hyptopus:* 9-26 °C, pH 4.3-7.6, DO 4.1-10.7 mg l^{-1}, 13-490 μS cm^{-1}, 5-120 NTU.

Family Synchaetidae Remane, 1933

Soft cuticled to more or less loricate; body conical, pyriform, cup-, bell-shaped, vasiform or saccate; corona of *Asplanchna* type with or without ciliary auricles; rigid bristles near mouth; elongate coronal sensillae curve inwards; mastax virgate with complex paired hypopharynx muscles; manubria closely associated with margin of pumping chamber; foot and toes present, rudimentary or absent. Of four described genera, *Ploesoma, Polyarthra* and *Synchaeta* are known from Australia; *Pseudoploesoma* is not.

Key to genera

1. Illoricate body, cuticle thin but maintains shape; corona with lateral ciliary auricles; foot more or less distinct with two short toes, occasionally one ..... *Synchaeta* Ehrenberg
   Auricles absent 2
2(1). Body illoricate, saccate-cuboidal; cuticle thin but rigid; foot absent; lateral bundles of rigid serrated fins ..... *Polyarthra* Ehrenberg
   Body loricate, generally with ornamented surfaces (ridges, fillets, etc); foot-opening or ventral aperture present; foot annular and distinct, two toes ..... *Ploesoma* Herrick

Ploesoma Herrick

Ploesoma Herrick, 1885, p. 57.

Body bean-shaped/saccate, distinctly loricate, variously ornamented: dorsal lorica anterior may have headshield, smooth or denticulate margin; ventral lorica closed, with foot-opening, or open with ventral aperture; foot in part or entirely annulate, with robust toes; corona of *Asplanchna* type, with two long digitiform palps in apical field; dorsal antenna displaced caudally; lateral antennae ventral in last third of body; mastax virgate, large, can be extruded to grasp food items; oesophagus long, with longitudinal striae; stomach in distal third of body. Of 7-8 species listed in Koste (1978a), two are recorded from Australia. All known species are planktonic or semiplanktonic carnivores, eating pelagic and benthic rotifers. Cannibalism is noted (Koste 1982).

Key to species of Ploesoma recorded from Australia

Anterior margin of headshield smooth, straight to undulate ..... *P. truncata* (Levander)
Headshield margin with median, short, triangular toothlike extension ..... *P. lenticulare* Herrick

Ploesoma lenticulare Herrick
FIG. 4:1

Ploesoma lenticulare Herrick, 1885, p. 57, Fig. 3a-b.
For extensive synonymy, see Koste (1978a).

Type locality: (U.S.A.).
Description: Occipital margin with smoothly rounded projection; lorica outline variable within and between populations; dorsal transverse furrow contains opening of dorsal antenna; three longitudinal furrows between this median furrow and occipital margin; extensive ornamentation as in Fig. 4:1a; lorica surface covered with small round knobs; ventral lorica with deep cup-shaped aperture; apical field with two digitiform palps, membranelles and sensillae. Trophi: fulcrum long, planklike in lateral view; rami without inner dentition, with large basal plates; manubria with lamellae, unci with two main teeth and striated plate. Male unknown.

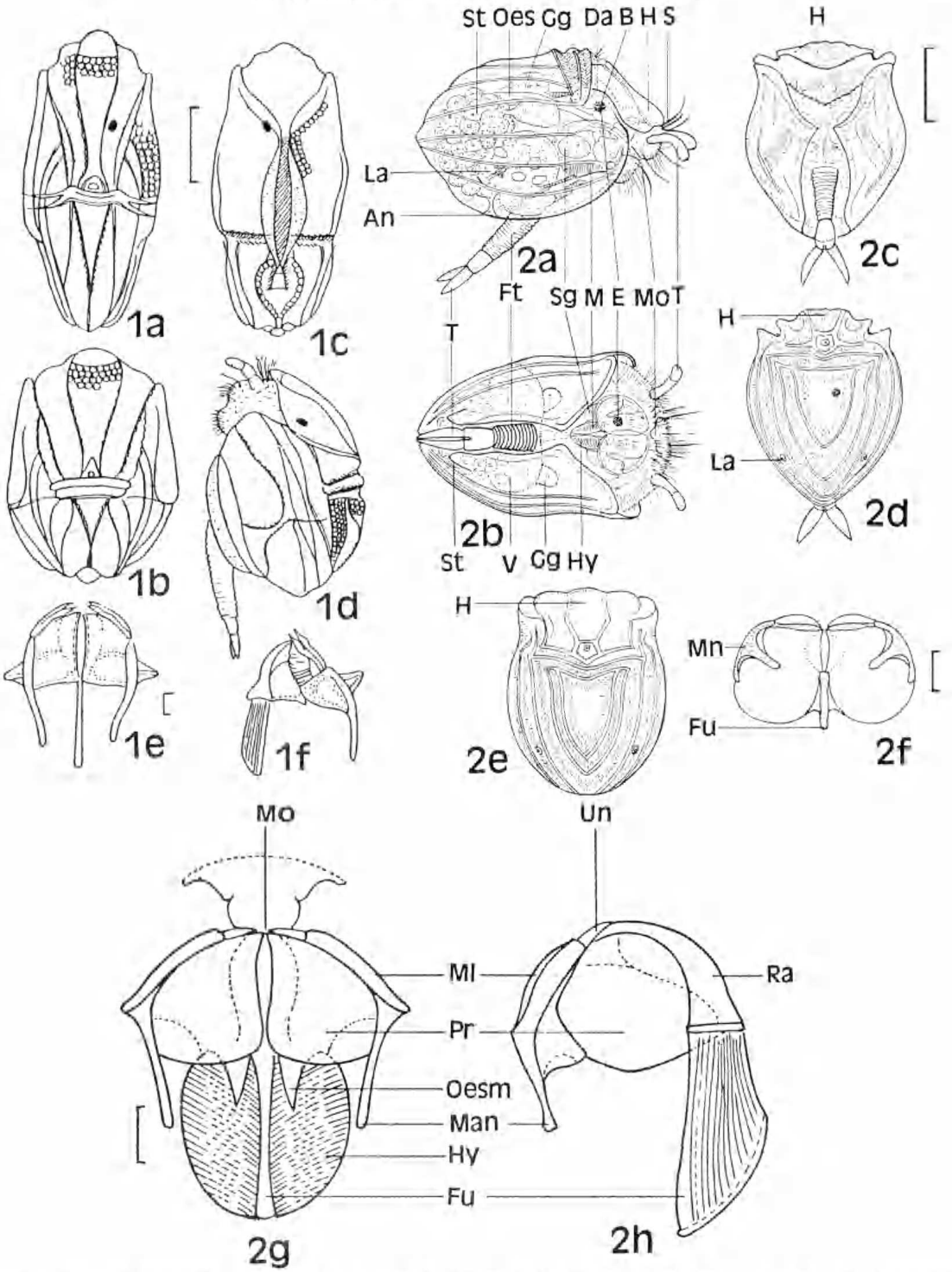


Fig. 4, 1. *Ploesoma lenticulare* Herrick: (a) dorsal; (b) dorsal, robust form; (c) ventral; (d) lateral, swimming; (e) trophus; (f) trophus, lateral. 2, *P. truncata* (Levander): (a) lateral; (b) ventral; (c) ventral, foot extended; (d) dorsal; (e) dorsal, contracted; (f) trophus, ventral; (g) trophus, dorsal; (h) trophus, lateral (B= brain; Da= dorsal antenna; E= eye; Ft= foot; Fu= fulcrum; Gg= gastric gland; H= headshield; Hy= hypopharynx muscle; La= lateral antenna; M= mastax; Man/Mn= manubrium; Ml= manubrial lamella; Mo= mouth; Oes= oesophagus; Oesm= insertion of oesophagus; Ra= ramus; SG= salivary gland; St= stomach; T= toe; V= vitellarium. (1 after Wulfert (1961), 2 after Koste (1982). Scale bars: adults 50 μm, trophi 10 μm.

BL 150-320 μm; FT 70 μm; T 18 μm; TR to 120 μm (FU 56 μm, M 34 μm, U 22 μm); RE 147×125 μm. A smaller morph from the Amazon (135 μm) has larger foot (79 μm) and trophi (128 μm: FU 77, R 51, M 23, U 26 μm) (Koste 1978a).

Distribution: Early record from N.S.W. (Whitelegge, 1889). Not seen again until Sept. 1991, when individuals of the robust morph (Fig. 4:1b) were found in samples from McCartney's Creek and Horseshoe Billabong in Barmah Forest (Vic.), persisting in the plankton until 12 Nov.: 15.0-21.2 °C, pH 7.3-7.6, 47-70 μS cm^{-1}.

Ploesoma truncata (Levander)
FIG. 4:2

Gastroschiza truncata Levander, 1894, p. 25, Fig. 1:9-10.
Ploesoma truncatum: Weber, 1898, p. 740, 743, Fig. 24: 8-10.

Type locality: Vicinity of Helsingfors (=Helsinki, Finland).

Description: Occipital margin almost straight, with lateral indentations; lines and furrows on dorsum form characteristic triangular ornamentation (Fig. 4:2d, e); foot partially annulated; toe of medium length; male unknown; RE with dark brown-black short-spined outer shell. Trophi: fulcrum rodlike in anterior view (Fig. 4:2g), broad, spatulate in lateral view (Fig. 4:2h); manubria crooked, almost 90° bend, both arms similar length, distal arm reaches only midpoint of fulcrum; large hypopharynx muscle for pumping.

BL 130-300 μm; FT 80 μm; TR: FU 36μm, M 26 μm either side of 'elbow', U 8 μm; SE & RE 60-70 ×82-90 μm.

Distribution: Single record from L. Ashwood, an acid dune lake near Strahan, W. Tasmania (Koste *et al.* 1988). 16.0 °C, pH 4.1, 131 μS cm^{-1}.

Polyarthra Ehrenberg
Polyarthra Ehrenberg, 1834, p. 226.

Body cylindrical, conical, saccate or cuboidal, in some species slightly flattened dorso-ventrally; cuticle transparent, stiffened; foot absent. At base of head, dorsal and ventral, two groups of three blade- or sword-shaped serrated finlike processes (variously termed finlets, fins, paddles or rudders) (Fig. 5) which are variable in length and width between populations. They are absent in first generation hatchlings from resting eggs. *P. dolichoptera* and *P. vulgaris* also have two obvious but shorter serrated fins on the ventral side (Fig. 6:1c). Corona of *Asplanchna* type; in apical field, two ciliated tentacles and sensillae; lateral antennae on distal third of body; trophi virgate (see Koste & Shiel 1987 for details of trophi structure); trophi musculature striated; vitellarium with 4, 8 or 12 nuclei; dwarf males are vasiform, finless, with ciliated penis and foot. Three form series were distinguished by Ruttner-Kolisko (1974), *viz: dolichoptera-vulgaris, remata-minor* and *major-eurvptera.* At present, six of ten taxa listed in Koste (1978a) have been recorded from Australia.

Comment: The difficulty of specific determination from preserved contracted material was noted by Koste (1978a). He recommended calculation of indices of body:fin length and fin length:width, carmine staining of vitellaria, NaOCl-clearing for trophi analysis, etc. Comparative indices were used successfully by Guiset (1977) to separate *Polyarthra* species in Spanish reservoirs. Some intergrades of body and fin-lengths have been reported, so collection of all the relevant morphometric information for a particular population may not ensure specific placement. It is likely that trophi are species-specific, and will enable accurate species recognition.

Key to species of *Polyarthra* known from Australia

1. Ventral fins present (Fig. 6:1c) 2
   Ventral fins absent 3
2(1). FW >15 μm; trophi as Fig. 8:3b ..... *P. vulgaris* Carlin
   FW <15 μm; trophi as Fig 6:1b ..... *P. dolichoptera* Idelson
3(1). BL >120 μm; vitellarium with 8 nuclei; trophi as Fig. 6:2b or 6:3b 4
   BL <120 μm; vitellarium with 4 nuclei; trophi as Fig. 8:1b or 8:2b 5
4(3). FW 8-11 μm; trophi as Fig. 6:2b ..... *P. longiremis* Carlin
   FW 20-37 μm; trophi as Fig. 6:3b ..... *P. major* Burckhardt
5(4). BL <70 μm; FW <5 μm; left dorsal fins notably longer than others; trophi as Fig. 8:1b ..... *P. minor* Voigt
   BL >80 μm; FW >5 μm; all fins similar length; trophi as Fig. 8:2b ..... *P. remata* (Skorikov)

Polyarthra dolichoptera Idelson
FIGS 5, 6:1

Polyarthra dolichoptera Idelson, 1925, p. 84.

Type locality: Novaja Zemla, Russia.

Description: Body an elongated cube, more slender

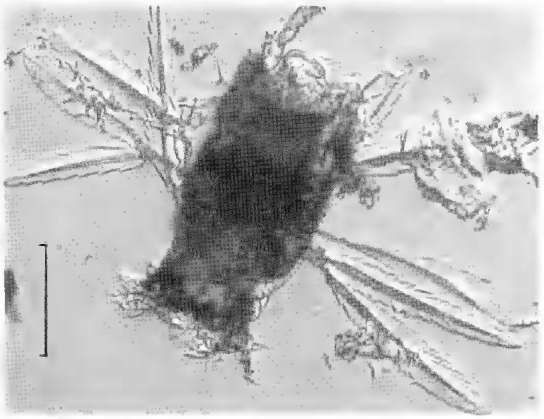


Fig. 5. *Polyarthra dolichoptera*, L. Hume, N.S.W. Dried onto slide to show fin morphology. Sony CVP-G700 video print. Scale bar = 50 μm.

than *P. vulgaris*; fins long, slender, extend beyond posterior margin; ventral fins fine, bristle-like, occasionally only a little broadened, finely serrated; median rib of fins distinct, continues to apex (Fig. 5) lateral ribs may be indistinct or absent; margins strongly serrated; lateral antennae at posterior corners; median eye; male known; RE with spinulate inner shell and rodlet reinforcement between inner and outer shells. TR asymmetric; each ramus resembles a hatchet with a single tooth on the 'blade' fitting a niche on the opposing blade; a reverse barb on distal end of blade leads to long, slightly convex 'handle' (bulla of ramus); viewed ventrally, lamellar rami form hemisphere (Fig. 6:Ib); long rodlike fulcrum, broader in lateral view.

BL 90-140 μm; FL 110-220 μm; FW 7-15 μm; ventral FL 60-72 μm; TR 60 μm; SE with large oil droplets; RE 56-72×36-56 μm; index FL:BL >1.

Distribution: Pancontinental in billabongs or lakes, also in spring in lower R. Murray plankton, S.A. (Shiel *et al.* 1982). More common/abundant in cooler waters, with isolated occurrences above 15 °C. 7.0-20 °C, pH 4.8-8.2. DO 6.6-12.5 mg l^{-1}, 9-1650 μS cm^{-1}, 1.5-120 NTU.

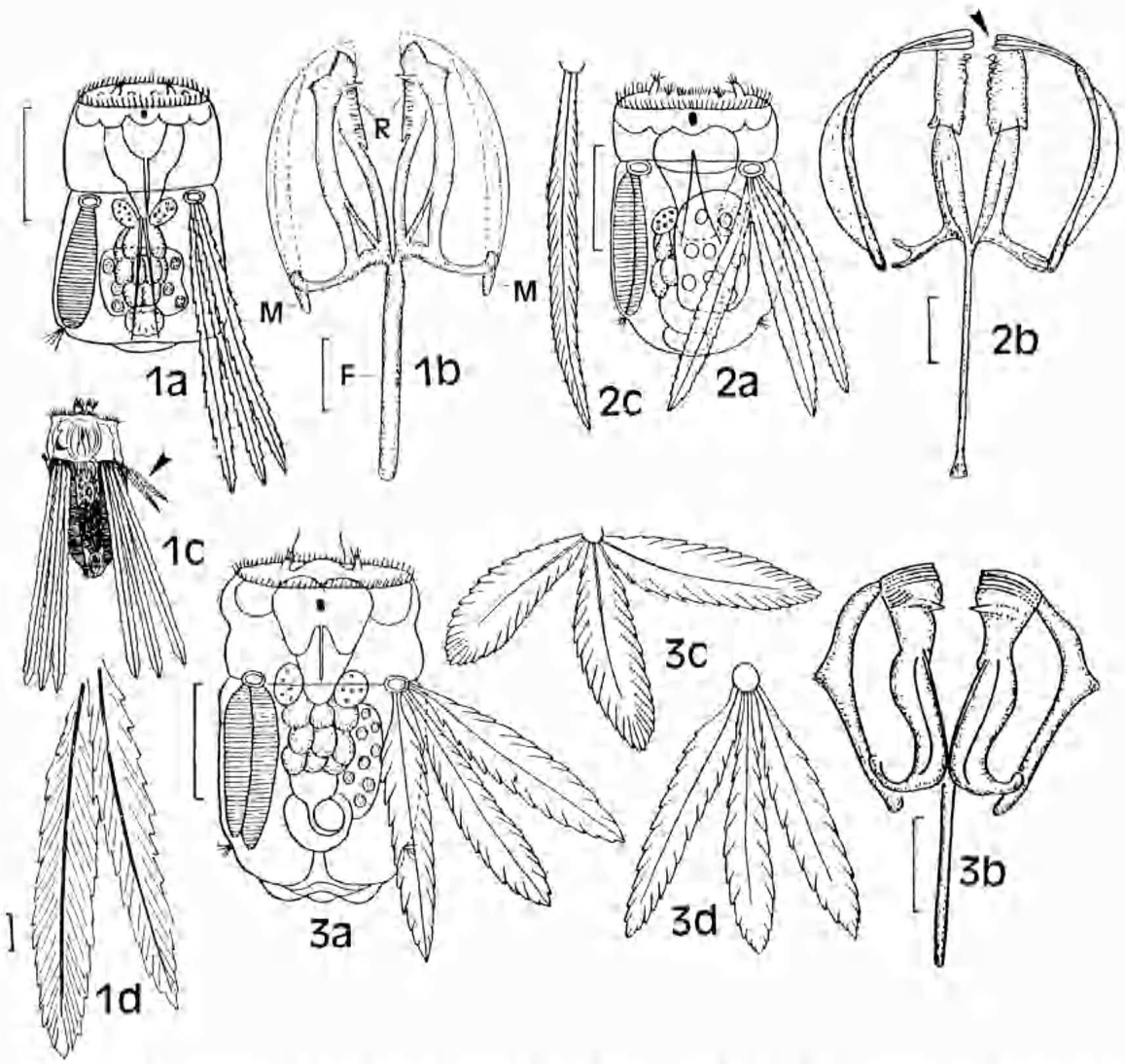


Fig. 6. 1, *Polyarthra dolichoptera* Idelson. (a) lateral, only 1 set of fins shown; (b) trophus, dorsal (f= fulcrum, l= lamella in front of m= manubrium, r= ramus); (c) lateral with both lateral fin groups and shorter ventral finlets (arrowed); (d) fin morphology, L. Hume specimen from Fig. 5. 2, *P. longiremis* Carlin: (a) lateral, only 1 set of fins shown; (b) trophus, dorsal; (c) fin morphology; 3, *P. major* Burckhardt: (a) lateral, only 1 set of fins shown; (b) trophus, (c,d) fin groups, dorsal. 1a, c, 2a, c, 3a, c, d after Kutikova (1962); 2b after Kutikova (1970). Scale bars: adults 50 μm, trophi 10 μm.

Polyarthra longiremis Carlin
FIG. 6:2

Polyarthra longiremis Carlin, 1943, p. 88, Fig. 1:3.

Type locality: Motala River, Sweden.
Description: Of similar body form to *P. vulgaris*, with wider caudal region; fins thin, commonly longer than body, reach considerably past posterior end; ventral appendages bristle-like. Vitellarium with eight nuclei; lateral antennae in distal ⅓ of body. TR symmetric, superficially similar to that of *P. dolichoptera* in ramus structure, but readily distinguished by three apical unci teeth opposing proximal to rami (arrowed in Fig. 6:2b), with serrate margins distal to unci; manubria curving rods with crescentic alulae on outer margin, meet subramal fossa at proximal end of fulcrum, almost at right angles to fulcrum (Fig. 6:2b).

BL 115-225 μm; FL 135-208 μm; FW 8-11 μm; ventral FL 61-66 μm; FL:BL >1; FL:FW >5.
Distribution: Recorded from Qld (Russell 1961), but not seen again until a 1985 sample series in Tasmania (Koste & Shiel 1986), where it occurred in Hydro-Electric Commission impoundments. It was found subsequently in a 1990 sample collected from L. Otaro, N.Z. (Coll. M.R. James, Taupo). 13.2-19.0 °C, pH 4.2-6.8, 21-215 μS cm^{-1}.

Comments: P. longiremis probably is more widely distributed in Australasia than sparse records indicate. Close examination of trophi structure is vital for any *P. dolichoptera*-like rotifer collected at >15 °C.

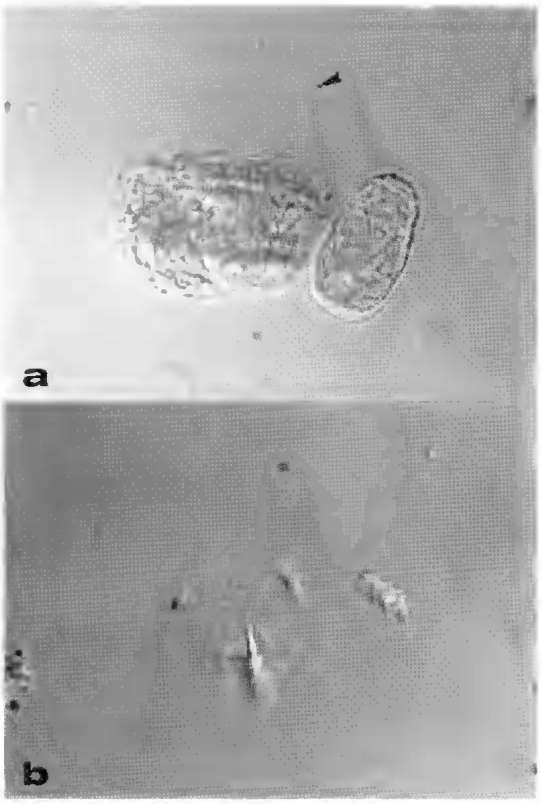


Fig. 7. *Polyarthra minor* Voigt: a, lateral, elongate dorsal fin set arrowed, BL 72 μm, egg 53×29 μm. b, trophus, 28 μm. Sony CVP-G700 video prints.

Polyarthra major Burckhardt
FIG. 6:3

Polyarthra major Burckhardt, 1900, p. 414.

Type locality: (Switzerland).
Description: Fins shorter than body, leaflike with midrib, feathered, weakly serrate; no ventral fins; lateral antennae inserted well before end of body; vitellarium with eight nuclei; male unknown; RE with outer colourless smooth shell and inner dark brown smooth shell. TR asymmetric: opposing rami teeth similar to those of *P. dolichoptera*. However, whereas ramus proximal to each tooth appears knoblike in dorsal view in *P. dolichoptera*, proximal ramus in *P. major* is serrated (cf. Fig. 6:3b); manubria with distinct 'elbow', ca. 120°.

BL 126-197 μm; FL 102-188 μm; FW 20-37 μm; FL:FW >5; FL:BL ≤1; RE 80-100×60-72 μm.
Distribution: Only two localities, Coliban Res and L. Catani, Vic., (Berzins 1982). Not seen in our material, unverified.

Polyarthra minor Voigt
FIGS 7, 8:1

Polyarthra minor Voigt, 1904, p. 33.

Type locality: Vicinity of Plön, Germany.
Description: Body relatively small and broad; lateral antennae medial; fins very slender; fins of left dorsal fin bundle considerably longer than other fins; vitellarium with four nuclei; SE carried attached; RE and ME unknown. Trophi asymmetric, similar to those of *P. remata*, although smaller; single pair of proximal large rami teeth, with series of smaller teeth distally (6-8), all fitting complementary niches in opposing ramus (Figs 7b, 8:1b); fulcrum rodlike in front view, with broader head laterally, i.e. similar shape to axe-handle.

BL 68-70 μm; FL 57-70/86-90 μm; FW 4 μm; FL:FW >5; FL:BL >1; TR 25-28 μm.

Distribution: Only known from a single locality, a billabong on Magela Ck floodplain, N.T. (Koste 1981, Tait *et al.* 1984), until 02.iii.92, when a population was recorded in Ryan's #2 Billabong on the R. Murray floodplain near Wodonga, Vic. 26 °C, pH 7.7, 296 μS cm^{-1}. Probably more widely distributed.

Polyarthra remata (Skorikov)
FIG. 8:2

P. platyptera var. *remata* Skorikov, 1896, p. 71, Fig. 7:3-4.
Polyarthra remata: Rodewald 1938, p. 147.

Type locality: Vicinity of Kharkov, Ukraine.

Description: Fins longer than body; posterior rounded/lobed; lateral antennae just before posterior corner; eyespot dark red-black; fins slender with robust midrib, no laterals; vitellarium with four nuclei; RE with smooth outer shell and wrinkled inner shell. TR asymmetric: single pair of acute unci teeth oppose at proximal margin of rami in dorsal view (Fig. 8:2b, arrowed); inner rami margins with single large and several smaller teeth (Fig. 6:2c); external margins of rami curved, lamellate, similar to *P. dolichoptera;* manubria rodlike, curved, extend slightly beyond rami lamellae margin.

BL 80-120 μm; FL 80-110 μm; FW 7-8 μm; RE 48-60×32-44; FL:FW >5; FL:BL=1.

Distribution: Known only from Vic. (Berzins 1963) and Tas. (Koste & Shiel 1987b). 13-16°C.

Polyartha vulgaris Carlin
FIG. 8:3

Polyarthra vulgaris Carlin, 1943, p. 87, Fig. 13.

Type locality: Motala R., Sweden.

Description: Fins lanceolate, with medial and lateral ribs, margins serrate; fins may extend past body margin; ventral fins slightly broadened, lightly serrated; RE reddish-brown with smooth outer shell, hooked inner shell and intermediate folded membrane;

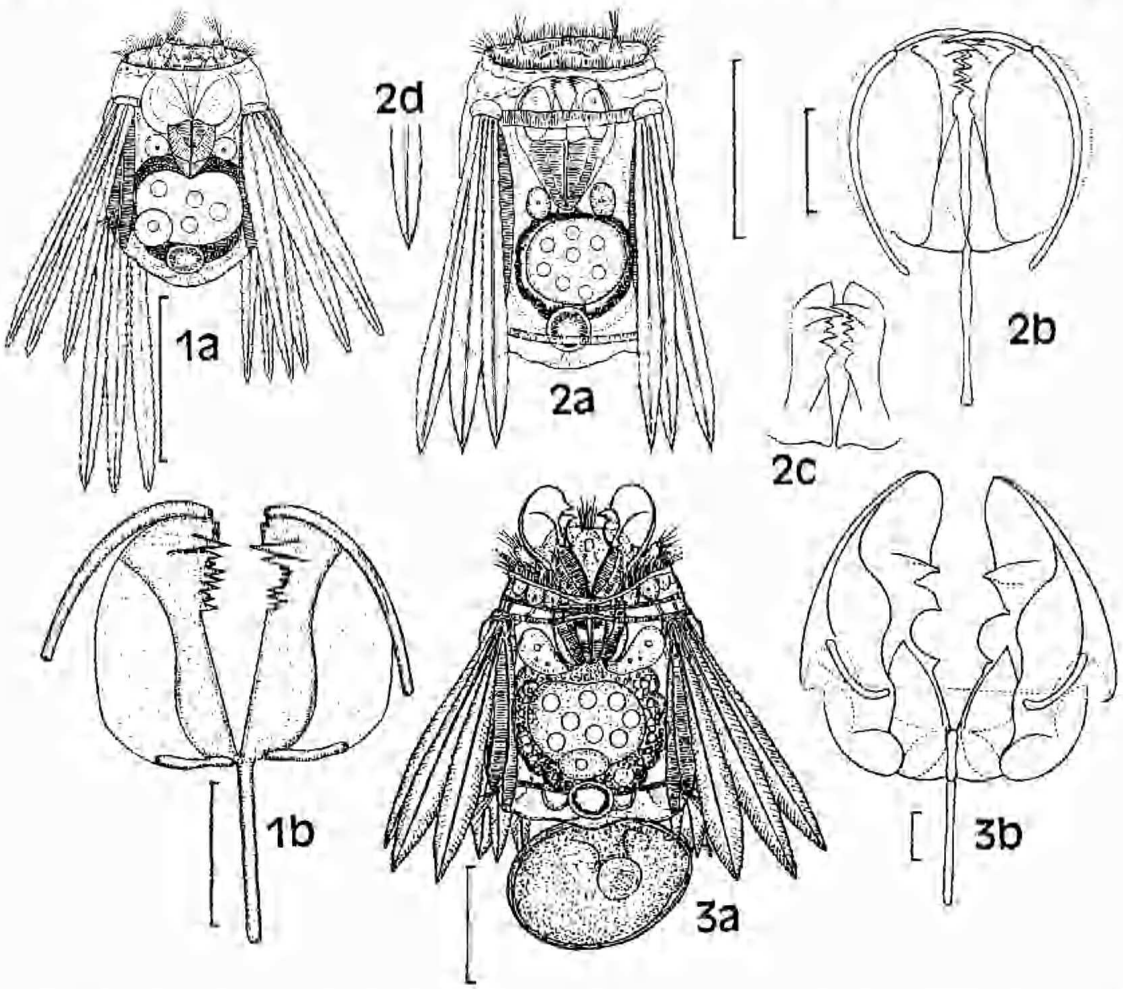


Fig. 8: 1, *Polyathra minor* Voigt: (a) lateral; (b) trophus, dorsal; 2, *P. remata* (Skorikov): (a) lateral; (b) trophus, ventral; (c) rami dentition; (d) tip of fin. 3, *P. vulgaris Carlin:* (a) lateral, trophus extruded, and carrying parthenogenetic egg; (b) trophus, ventral (from Magela Creek, N.T. specimen) 1a, 2, 3b after Chengalath & Koste (1988). Scale bars: adults 50 μm, trophi 10 μm.

SE lightly coloured to transparent, with a large oil droplet; ME (up to six) carried attached; TR asymmetric; in dorsal view two large teeth on left ramus (Fig. 8:3b); single tooth on right ramus fits between them; rami borders distal to teeth hemispherical, complementary, left convex, right concave in dorsal view.

BL 100-145 μm; FL 118-160 μm; FW 16-20 μm; ventral FL 30-70 μm; RE 78-88×52-60 μm; SE 76×50 μm; ME 26×26 μm.

Distribution: Most common *Polyarthra* in Australian waters, pancontinental in lentic waters, also common in lower R. Murray plankton (autumn) (Shiel *et al.* 1982). 7.2-29.0°C, pH 4.9-8.7, DO 1.5-12.0 mg l^{-1}, 13-1100 μS cm^{-1}, <1-110 NTU.

Synchaeta Ehrenberg

Synchaeta Ehrenberg, 1832, p. 135.

Cuticle transparent, pliable; body conical-vasiform, depending on ingested food, size of vitellarium and egg development; foot short, one-segmented; toes generally acute; corona an interrupted circumapical band with widely projecting ciliary auricles; apical field with four styli, elongated ciliated tentacles and sensillae; dorsal antenna in neck; lateral antennae in posterior ⅓ or at base of foot; mastax large with distinct striated muscles; trophi virgate, large, delicate; fulcrum and manubria long, thin; in some taxa unci acute, with comblike serrated edge; internal organ is as in Fig. 8:1. SE and RE appear to have species specific morphology; males are known for some species only; >30 species described globally, but taxonomic resolution imprecise. About 20 of these are from athallasic saline or marine waters (Ruttner-Kolisko 1974; Koste 1978a). Marine rotifers, including synchaetids, have been neglected in Australasia. Only *S. baltica* has been reported off Port Jackson by Whitelegge (1889), and in Port Phillip Bay (Evans 1951). It is not included in the key, but a description is given for convenience. It is likely that further marine species of *Synchaeta*, *inter alia*, will be found here. A list of known marine synchaetids and relevant bibliography is given by Ruttner-Kolisko (1974). Ten *Synchaeta* species have been reported from inland waters, including a new endemic species described here. It was first recorded by the late C. R. Russell, Christchurch N.Z., from a sample taken in 1959 in Warragamba Dam but apparently not described.

Key to species of Synchaeta known from Australia

1. Uncus of trophus with one main tooth, no accessory teeth 6
   Uncus with main and accessory teeth 2
2(1). Lateral antennae in posterior third of body 3
   Lateral antennae near base of foot ..... *S. tremula* (Müller)
3(2). Marked constriction below ciliary auricles (Fig. 8:3a) ..... *S. lakowitziana* Lucks
   No obvious constriction 4
4(3). Body cylindrical; auricles small; toes 9-10 μm; unci with 4-5 robust teeth ..... *S. lavina* Hood
   Body coniform; auricles not small; toes ≤5 μm; unci with 5-8 teeth 5
5(4). Apical field flat; uncus 6-8 toothed ..... *S. oblonga* Ehrenberg
   Apical field domed; uncus 5-6 toothed ..... *S. littoralis* Rousselet
6(1). Two large ciliated tentacles in apical field ..... *S. pectinata* Ehrenberg
   Apical field smooth or with ciliated humps 7
7(6). Trunk medially constricted, elongated (Fig. 8:2a); BL >400 μm ..... *S. grandis* Zacharias
   No obvious constriction, trunk convex at sides; BL to 320 μm 8
8(7). BL <200 μm; foot elongated 9
   BL 200-313 μm; foot not elongated ..... *S. stylata* Wierzejski
9(8). BL >150 μm; foot and toes as Fig. 12:3 ..... *S. longipes* Gosse
   BL <150 μm, foot and toes as Fig. 11:1 ..... *S. jollyi* sp.nov.

Synchaeta baltica Ehrenberg
FIG. 9:1

Synchaeta baltica Ehrenberg, 1834, p. 220.

Type locality: (?Europe).

Description: Bell-shaped/conical; foot long, cylindrical; trunk may be annulated in posterior; toes short; foot glands short, indistinctly separated; lateral apical sensillae on papillae; male not described; RE with projecting integument. TR not described.

BL 190-523 μm.

Distribution: Marine, estuarine, coastal waters worldwide. Two records: one off Sydney (Whitelegge 1889) and Port Philip Bay (Evans 1951).

Synchaeta grandis Zacharias
FIG. 9:2

Synchaeta grandis Zacharias, 1893, p. 23, Fig. 2.

Type locality: Plöner See, Germany.

Description: Body very long, usually cylindrical behind medial constriction; colourless except for yellowish tint to ciliary auricles and protruding apical field; foot and foot glands long; toes very short; eye red or black, circular; oesophagus very long. Trophi: uncus a broad plate with very fine denticles (Fig. 9:2c); fulcrum long, slender; manubria with semicircular outer lamellae; male undescribed; SE, RE, ME with fine spines.

BL 400-600 μm; head width 180-200 μm; SE & RE 80-92×70-80 μm; ME 56×54 μm.

Distribution: Rare in our samples (5 of ca. 5000 to date): billabongs & mainstream R. Murray near Wodonga, Vic., Yarnup Swamp, W.A. and a single record of a *Synchaeta* resembling *S. grandis* from a humic stock dam at Karanja, near Mt Field National

Park, in Tasmania (28.IX.87) (Koste *et al.* 1988): 10-16 °C, pH 6.0-7.6, DO 10.7 mg l^{-1}, 64-166 μS cm^{-1}, 8 NTU.

Synchaeta sp. nov.

While a Visiting Researcher at Waikato University in May-June 1993, RJS chanced upon the notes of the late C. R. Russell held at the Canterbury Museum in Christchurch, N.Z. Cecil Russell was the "Honorary Keeper of Rotifers" at the Museum until his death in 1961, and had published extensively on the N.Z. rotifers in the period 1945-1961, with two papers including Australian rotifers (Russell 1957, 1961). In one of his laboratory notebooks, he listed "*Synchaeta* n. sp." from a sample collected in Warragamba Dam, N.S.W., by V. H. Jolly, (W2 27.X.59). The brief description and pencil sketches of animal and trophi in Russell's laboratory notebook (Fig. 11:1a, b) were not published prior to his death, and the taxon had not been collected again. We could not recognise it as one of the known *Synchaeta* species reviewed by Koste (1978). Fig. 11:1a, b are copied from ca. p. 49 of Russell's "Feb. 1 1960 — Australian Rotifers" notebook, and the description below from the following page. The text is verbatim, parentheses are used where a word is not clear, and some punctuation has been inserted:

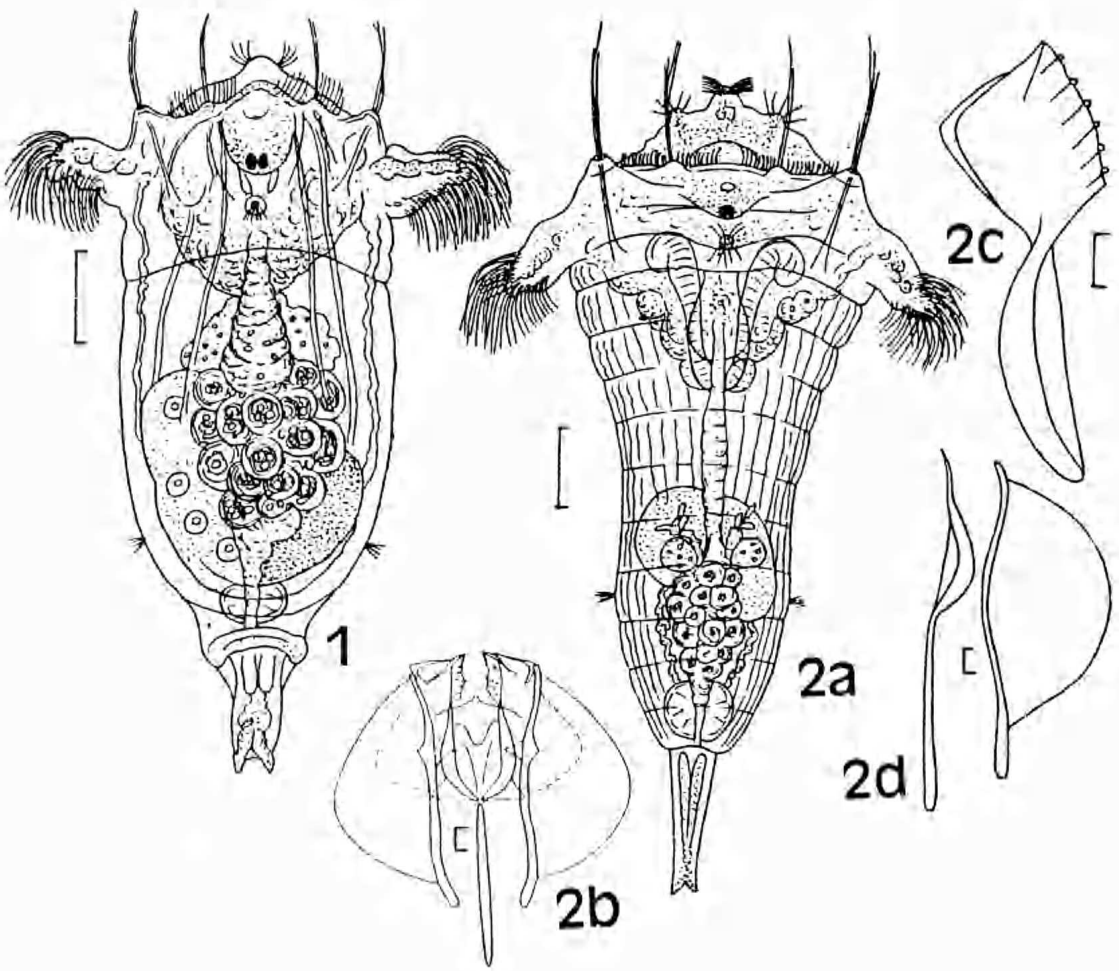


Fig. 9. 1, *Synchaeta baltica* Ehrenberg, dorsal. 2, *S. grandis* Zacharias: (a) dorsal; (b) uncus and ramus; (c) ramus and fulcrum; (d) manubrium, two views. 1, 2a after Rousselet (1902); 2b after Stemberger (1979); 2c, d after Kutikova (1970).. Scale bars: adults 50 μm, trophi 10 μm.

"*Synchaeta* n.sp.
Body conical, small; auricles small with weak cilia. Foot obsolete, toe single, with enigmatic dirty end, (immovable); antennae 4 short. Trophi with single tooth on each ramus, a modification of *pectinata* type having one tooth in each ramus; the rami are slightly triangular.
Length of body 120-130 μm. Length of toe 10 μm. Length of trophi 70-80 μm.
In the contracted animal has a marked curved anterior margin. This animal differs from other species of *Synchaeta* in its small size (*these two words have been crossed out*) (unmistakable) toe, absence of foot, difference in trophi, particularly the plate."

No material could be found in the Russell slide collection held at the Canterbury Museum. To determine the identity of this taxon, the assistance of Tsuyoshi Kobayashi at Australian Water Technologies, Science and Environment was sought. He found early collections (Nov. 1965) by Sydney Water Board from Warragamba Dam which contained four individuals of a *Synchaeta*, but Russell's species was not present. The species was therefore described as *Incertae sedis* in the first draft of this paper. Fortuitously, Fitzroy R. samples sent by Larelle Fabbro, from the University of Central Qld, arrived while the MS was with referees. The first specimens encountered (by RJS) were undoubtedly the same as those seen by Russell. Several were sent to WK, who verified that the taxon, although similar to *S. longipes*, appeared to be new.

Synchaeta jollyi sp.nov.
FIGS 10-12

Type locality: impoundment of Fitzroy R., near Ramsey Ck inlet, 70 km upstream of barrage at Rockhampton Qld, (approx. 23°05′S/150°00′E), 07.i.1993, Coll. L. Fabbro, Univ. Central Qld, Rockhampton.
Holotype: Single female, mounted in glycerine-gelatine. South Australian Museum (SAM) V4244. Date and place of collection as above.
Paratypes: Four females on slide V4245, SAM. Date and place of collection as above. Two slides, *Synchaeta* collection, MDFRC #4090. 30 ml plankton sample containing *S. jollyi* from Fitzroy R., Qld, MDFRC #4090. Date and place of collection as above.
Material examined: Ten females were examined and measured.
Description: (from partially contracted individual). Small conical body; head slightly convex; auricles small, face forward, with slight lateral bulges in slightly contracted animal; body broad for two-thirds of length, tapers to rounded posterior (Fig. 10, 11;2a); single median crimson cerebral eye; lateral antennae at midline; distinctive long cylindrical foot, not retracted in preserved individuals, presumably not retractible. *S. longipes* has an elongated retractible foot; paired foot glands elongated, cylindrical; two minute toes, barely discernible. Trophi: large in relation to body; uncus single toothed (Fig. 12a) (cf. *S. pectinata*); fulcrum straight, rodlike in anterior view, slightly curved in lateral view (Fig. 12b); manubria curved with hemispherical lamellae; male unknown; SE, RE, ME unknown. BL 107±7.8 μm; BW 90±4.2 μm; F/T 23.6±4.5 μm; TR 70-82 μm (FU 54 μm, M 68 μm).
Distribution: Only two localities known: type locality, the Fitzroy R. near Rockhampton, Qld., and Warragamba Dam (now L. Burragorang) N.S.W., one of Sydney's water-supply reservoirs. Probably more widespread.
Etymology: This rotifer is named after the late Dr Violet Hilary Jolly, one of Australasia's first fresh-water ecologists. While with the Sydney Water Board in 1959, she collected the samples which ultimately led to the rediscovery of this species.

Synchaeta lakowitziana Lucks
FIG. 13:1

Synchaeta lakowitziana Lucks, 1930, p. 59, Figs A-F.

Type locality: (?Europe).
Description: Marked constriction in neck region noted in original description possibly artefact of cocaine narcotization and formalin preservation; plump elongate body; dorsally, shape of head pentagonal; lateral sensillae on short papillae; toes acute; vitellarium bilobed; foot glands small. Trophi: uncl plates with 1-2 large dagger-like teeth and 6-7 accessory teeth (Fig. 13:1c); SE smooth, RE spinulate.

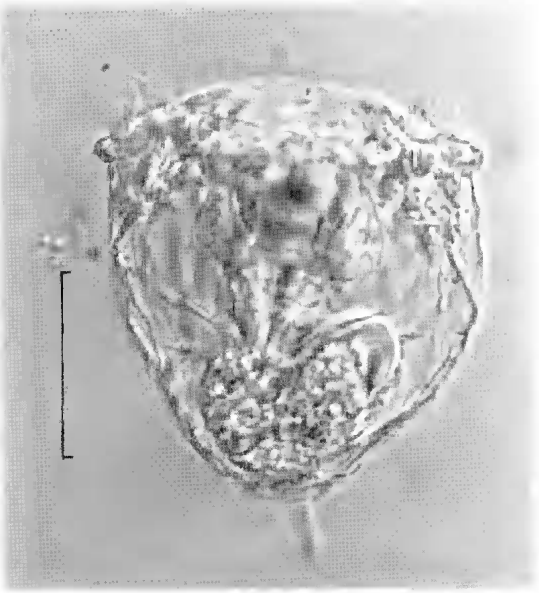


Fig. 10: *Synchaeta jollyi*, sp.nov. Fitzroy R., Qld. Coll. L. Fabbro, Univ. Central Qld. Sony CVP-G700 video print. Scale bar = 50 μm.

TL 350-300 μm; male 110 μm; RE 72×64 (Fig. 13:1f) or 67×45 μm with 15 μm long spines (Fig. 13:1g).

Distribution: In Europe, cold stenotherm in winter plankton of mountain lake hypolimnia and arctic waters. Three Australian localities known, but in view of European habitat preferences of this species, all populations require detailed examination: two mainland rivers: Moorabool R., Vic. in 1954 (Berzins 1982), lower R. Murray in S.A. (Shiel & Koste 1985), and a humic roadside pool near L. Garcia in W. Tasmania (Koste *et al.* 1988), 17.0-17.5 °C, pH 3.1-7.0, 81-500 μS cm^{-1}, <1-150 NTU.

Synchaeta littoralis Rousselet
FIG. 13:2

Synchaeta littoralis Rousselet, 1902, p. 398, Fig. 7:15.

Type locality: (U.K.).

Description: Resembles *S. oblonga*, but apical field more domed; two-part cerebral eyspot with stream of

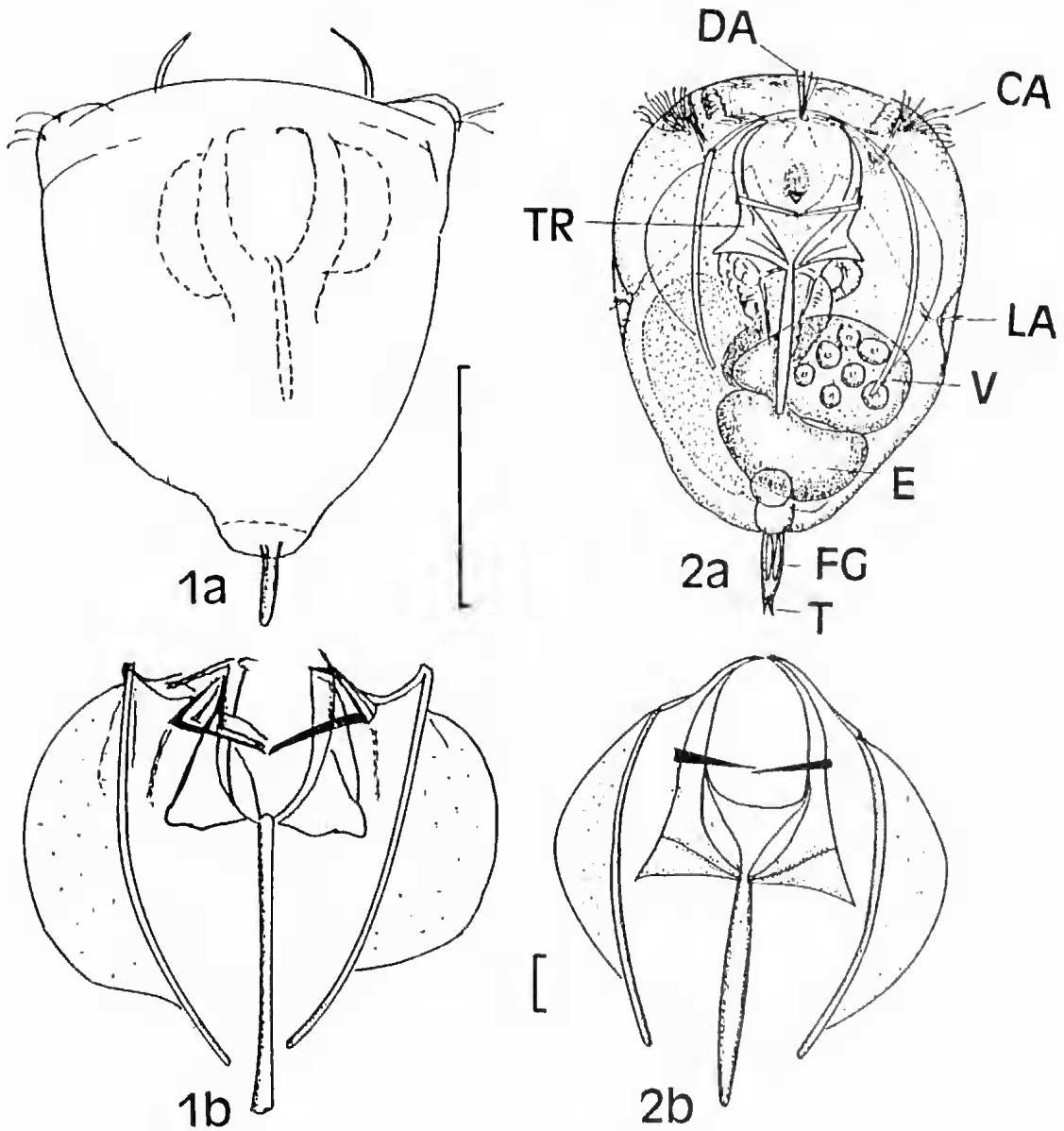


Fig. 11, *Synchaeta jollyi*, sp.nov. 1, (a) contracted; (b) trophus. 2, (a) contracted, (b) trophus. 1 from original pencil sketch by C.R. Russell, Canterbury Museum, Christchurch, N.Z. Coll. Warragamba Dam, 27.X.59, V.H. Jolly. 2, Fitzroy R. specimen. Scale bars: adults 50 μm, trophi 10 μm.

red granules to large red cervical eyespot; pigment granules diffuse in cold period, increase in density in spring; foot trapezoid; toes very short. TR undescribed.

TL 192-290 μm; toe 5 μm.

Distribution: S. cf. *littoralis* was collected in a billabong at Wodonga, Vic. (winter) (Koste & Shiel 1980), 10.2°C, pH 7.2, DO 9.0 mg l^{-1}, 154 μS cm^{-1}, 4 NTU. A few individuals were collected in L. Colongulac, Vic. (17.V.80), 13.0°C, no other ecological information.

Synchaeta longipes Gosse
FIG. 13:3

Synchaeta longipes Gosse, 1887, p. 5, Fig. 2:15.

Type locality: " . . . near Dundee". Lacustrine.

Description: Broad, protruding triangular head with widely spaced ciliary auricles directed somewhat posteriorly; body broadest at level of lateral antennae; foot clearly demarcated from body, cylindrical, long, thin, with two small toes; cuticle transparent or with bluish tinge; mastax orange-red, occasionally with bluish flecks in trophus region. Trophus: unci with acute robust tooth; manubria slightly sigmoidal with small triangular alulae on proximal third of external margin; SE rounded ellipsoid, smooth shelled; RE with rodlets between shells; yellow RE contents contain red-orange oil droplets; male unknown.

TL 164-204 μm; T 6-7 μm; SE 60×56 μm; RE 72-76×56-60 μm.

Distribution: Probably pancontinental, not yet recorded from W.A. Rare, in billabongs and rivers, in winter-spring plankton of lower R. Murray, S.A. (Shiel *et al.* 1982): 8.5-27.0°C, pH 6.2-8.5, DO 6.3-10.4, 27-400 μS cm^{-1}, <1-160 NTU.

Synchaeta oblonga Ehrenberg
FIG. 13:4

Synchaeta oblonga Ehrenberg, 1832, p. 135.

Type locality: (?Europe).

Description: Variable morphology; trunk generally barrel-shaped, laterally convex, but may be bell-shaped or ovoid; cuticle with longitudinal striae, colourless or yellowish; foot conical, toes short, bulbous; eyespots of different size, generally separated, also with speckled pigment granules; some populations may have fused eyespots; dorsal antenna normal; lateral antennae minute. TR: unci 6-8 toothed, generally symmetrical with notch behind main tooth and second notch behind

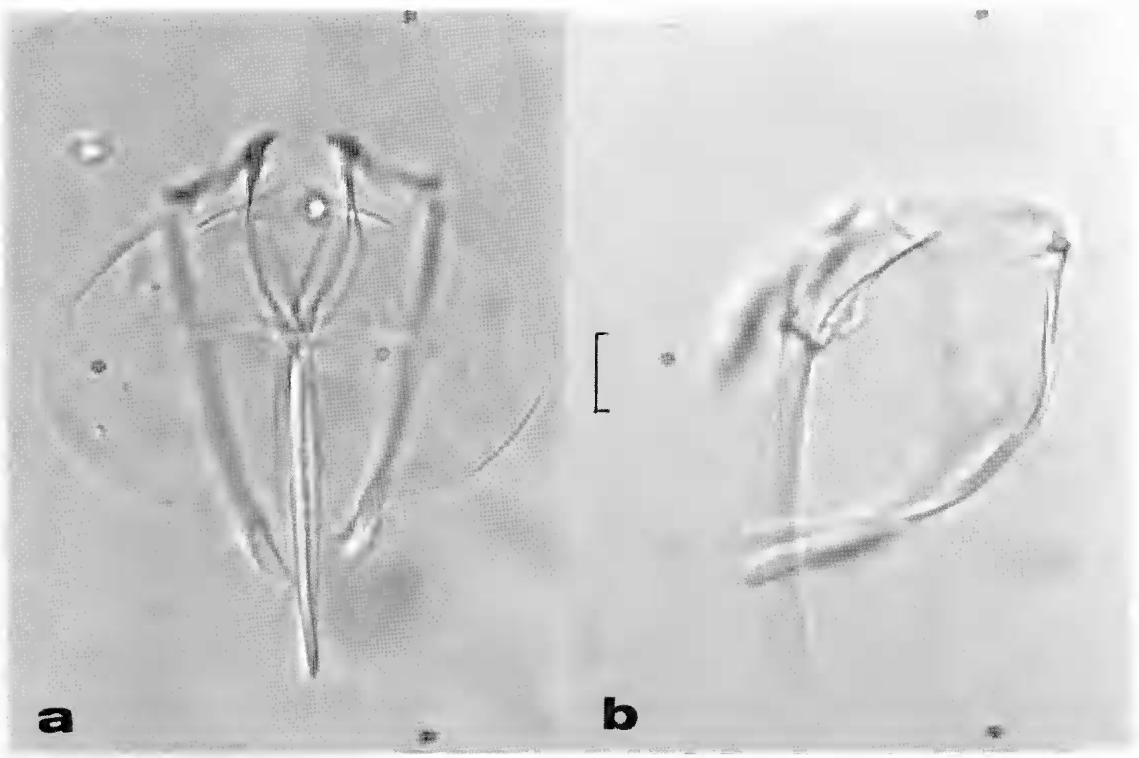


Fig. 12: *Synchaeta jollyi* sp.nov. Trophus (a) dorsal, (b) lateral. Sony CVP-G700 video prints. Scale bar = 10μm.

group of accessory teeth (Fig. 13:4c). Rami with rounded alulae; manubria with distal oarlike flattening and semicircular alulae; SE carried only a short time; RE with short spines on inner and outer shell; male known.

TL 225-250 μm; male 95-102 μm; SE 62×58 μm; RE 56-64×56-60 μm.

Distribution: In reservoirs, billabongs and rivers, most common of the smaller *Synchaeta* species in our samples, often with *S. pectinata*. NSW, Tas., Vic., W.A. Probably more widely distributed in Australia than present limited records indicate. 9.0-23.0, pH 4.8-10.0, DO 6.2-11.0 mg l^{-1}, 9-1650 μS cm^{-1}, 2-150 NTU.

Synchaeta pectinata Ehrenberg
FIG. 13:5

Synchaeta pectinata Ehrenberg, 1832, p. 135.

Type locality: (?Europe).

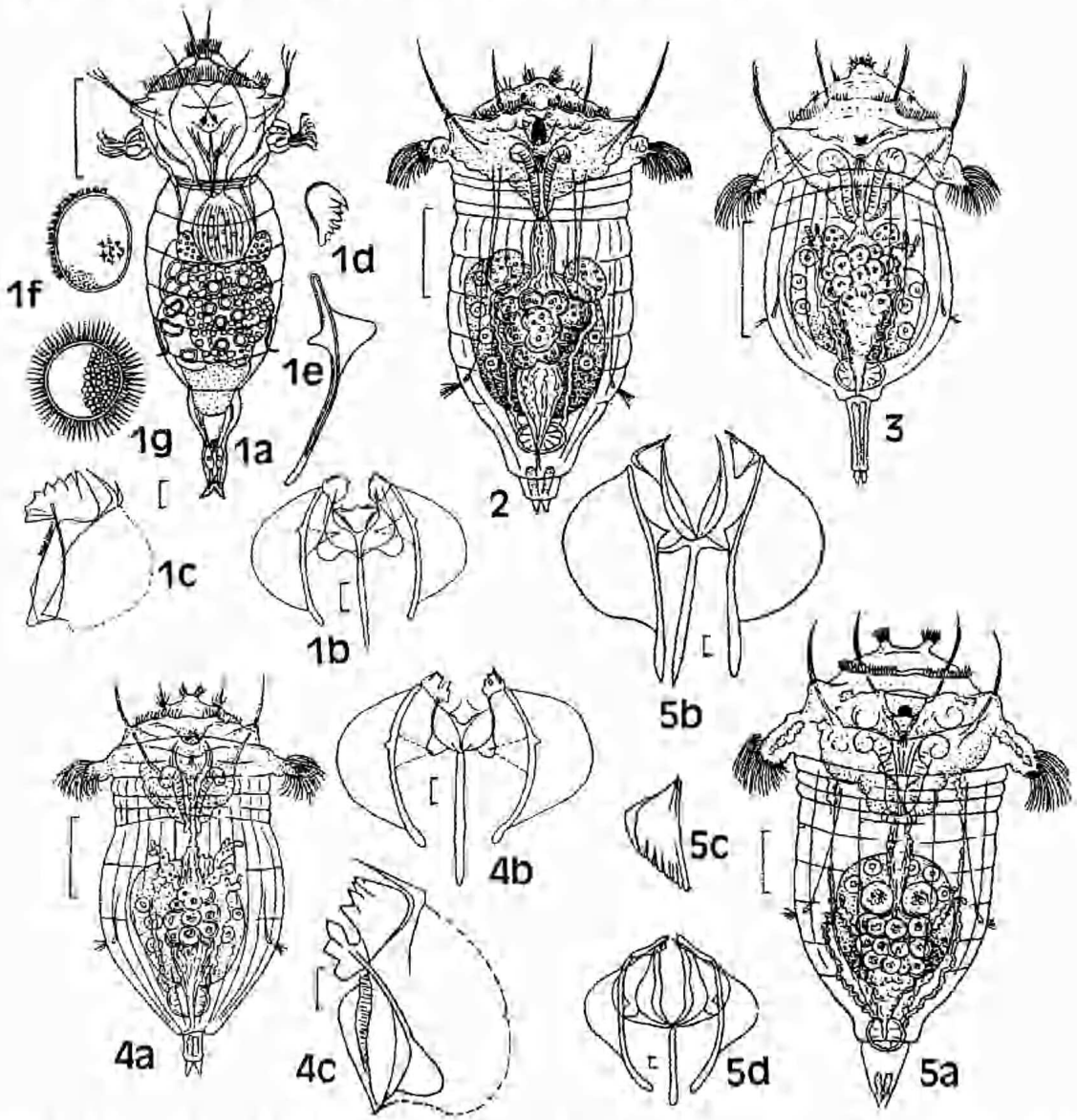
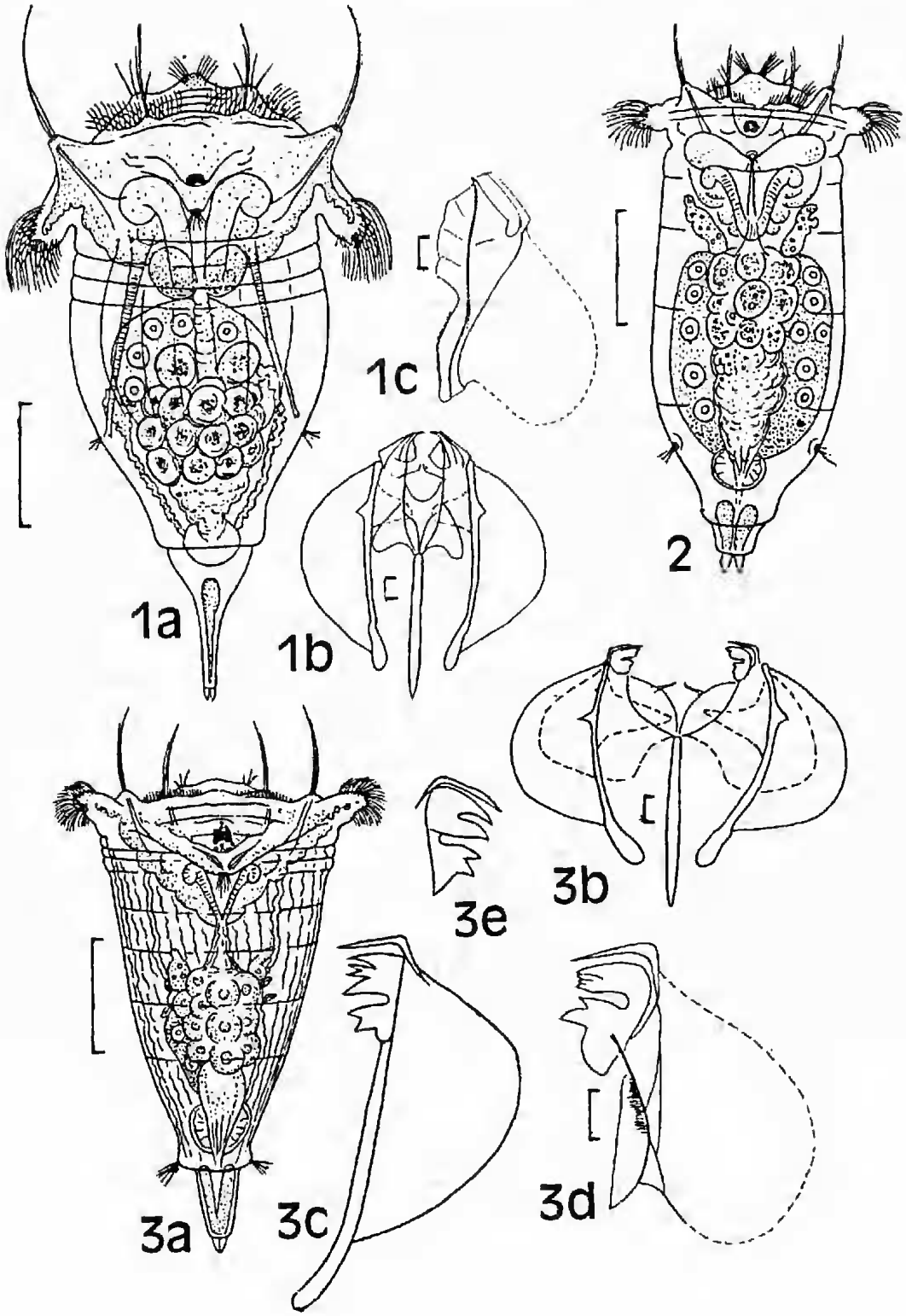


Fig. 13. 1, *Synchaeta lackowitziana* Lucks: (a) dorsal; (b) trophus; (c) uncus & ramus; (d) uncus; (e) manubrium; (f,g) resting eggs. 2, *S. litoralis* Rousselet: dorsal. 3, *S. longipes* Gosse: dorsal. 4, *S. oblonga* Ehrenberg: (a) dorsal; (b) trophus; (c) uncus & ramus. 5, *Synchaeta pectinata* Ehrenberg: (a) dorsal; (b,d) trophi; (c) uncus. 1a, d-g after Lucks (1930); 2, 3, 4a, 5a, d after Rousselet (1902); 1b, c, 4b, c after Stemberger (1979); 5c, d after Kutikova (1970). Scale bars: adults 50 μm, trophi 10 μm.


1a
1b
1c
2
3a
3b
3c
3d
3e

Description: Two ciliated tentacles in apical field; foot short and wide; toe relatively small; foot glands shorter than foot; eyespot dark red or purplish; lateral antennae at beginning of distal third of body. TR: unci platelike with grooved facing margins; rami crescentic, acute at proximal tips; fulcrum long, rodlike viewed dorsally, broader laterally; manubria rodlike with median shallow U-bend; broad crescentic lamellae along ca. ¾ of outer manubrium (Fig. 13:5b, d); SE with oil droplets and gelatinous sheath; RE either thin-shelled with small hooks or more robust and spiny.

TL 240-550 μm; toes 5-8 μm; male 160 μm; TR 190 μm; SE 75 μm; RE 80-90 μm.

Distribution: Largest and most common *Synchaeta* in our samples; pancontinental in billabongs, stock dams, lakes and impoundments, also in lowland rivers; autumn-winter occurrence in lower R. Murray (Shiel *et al.* 1982). 7.0-29.0°C, pH 3.9-8.7, DO 4.0-10.6 mg l^{-1}, 9-1000 μS cm^{-1}, <1-150 NTU.

Synchaeta stylata Wierzejski
FIG. 14:1

Synchaeta stylata Wierzejski, 1893, p. 404.

Type locality: Galicia, Poland.

Description: Resembles *S. longipes;* body tapers to base of foot; foot arises from a broader base than in other species, is not as clearly demarcated from trunk; toes very short; apical field mostly smooth, eyespot single, occasionally paired; lateral antennae in distal third of body; male known; SE and ME with relatively long, delicate bristles, RE with shorter bristles into gelatinous sheath; TR: unci tips curve inwards; manubria lamellae margin serrated.

TL 200-313 μm; FT 33-50 μm; T 4 μm; Male 89 μm; SE 64-74×50 μm; RE 80×68 μm.

Distribution: Uncommon in NSW, Qld, but most common and perennial *Synchaeta* in lower R. Murray plankton, S.A. (Shiel *et al.* 1982). 8.0-27.0°C, pH 7.0-8.5, DO 7.0-11.8, 60-1100 μS cm^{-1}, 1-110 NTU.

Synchaeta tavina Hood
FIG. 14:2

Synchaeta tavina Hood, 1893, p. 382, Fig. 17.

Type locality: (?U.K.).

Description: Body almost cylindrical; auricles small; foot and toe short; vitellarium with 8-12 nuclei; foregut present; eyespots generally paired, occasionally single larger fused eyespot (may be violet-red); lateral antennae deeply inserted; TR: unci with 4-5 robust teeth; rami with triangular upcurving alulae; fulcrum rodlike distally, laterally forms a striate semicircle.

BL 176-254 μm; a 176 μm specimen was 61 μm wide at the head with T 9-10 μm; TR 56 μ FU 26 μm, R 38 μm, M 40 μm).

Distribution: Rare, recorded from only four localities: a flooded gravel pit nr Eildon, Vic., Cullen's L. and Little Coliban Res., Vic., single record in lower R. Murray plankton, S.A. (spring) (Shiel *et al.* 1982). 18.0-23.0°C, pH 7.0-8.0, DO 8.3-11.0 mg l^{-1}, 70-602 μS cm^{-1}, 65 NTU.

Synchaeta tremula (Müller)
FIG. 14:3

Vorticella tremula Müller, 1786, p. 280, Fig. 61.4-7.
Synchaeta tremula: Ehrenberg 1832, p. 135.

Type locality: (Europe).

Description: Barrel- to cup-shaped body, often yellowish in colour; cuticle with striae; toes short, stout; eyespots sometimes with clusters of pigment granules; transitional forms with *S. oblonga* are known, also seasonal variants and ?ecotypic morphs in brackish-saline waters (Koste 1978a); SE smooth-shelled, occasionally in gelatinous sheath; two RE forms: with fine bristles or with short spines. Male known. TR: unci asymmetric, each uncus with single main tooth, 4-6 accessory teeth, also smaller denticles, separated by deep notches. Manubria slightly thickened medially.

BL 150-328 μm; T 8-11 μm; Male 110 μm; SE 93×76 μm, ME 62×51 μm; RE 75×68 μm.

Distribution: Rare, eleven records from Barwon R., Qld and downstream Darling R., N.S.W., central Tasmania, Waranga Basin and upper Murray billabongs, Vic. 10.0-16.0°C, pH 4.9-9.2, DO 8.1-10.0 mg l^{-1}, 19-355 μS cm^{-1}, 4.0 NTU.

Family Asplanchnidae Harring & Myers, 1926

Relatively large animals (to 2.5 mm); cuticle thin, transparent, but retains shape, which may be saccate, pear- or barrel-shaped, sometimes with lateral protrusions (cf. Fig. 17:5a); foot and toes are present in the swimming or creeping *Harringia*, rudimentary in semiplanktonic *Asplanchnopus*, lost in *Asplanchna*, an adaptation to a fully pelagic existence. Corona of *Asplanchna*-type (see Koste & Shiel 1987). All three genera have incudate trophi, that of *Harringia* does not have a suction function. *Asplanchnopus* and *Asplanchna* do not have intestine, cloaca or anus. *Harringia* is not known from Australia. Two species of *Asplanchnopus* and seven of *Asplanchna* are known from Australia; one species, *A. asymmetrica*, is endemic.

Fig. 14: 1, *Synchaeta stylata* Wierzejski: (a) dorsal; (b) trophus; (c) uncus & ramus. 2, *S. tavina* Hood, dorsal. 3, *S. tremula* Ehrenberg: (a) dorsal; (b) trophus; (c) uncus, ramus & manubrium; (d) uncus & ramus; (e) uncus. 1a, 2, 3a, e after Rousselet (1902); 1b, c, 3b, d after Stemberger (1979); 3c after Kutikova (1970). Scale bars: adults 50 μm, trophi 10 μm.

Key to genera

With rudimentary foot and toes ..... *Asplanchnopus* De Guerne
Foot and toes absent ..... *Asplanchna* Gosse.

Asplanchnopus De Guerne, 1888

De Guerne 1888, p. 57.

Cuticle flexible, transparent; body saccate or pear-shaped, with or without protrusions; corona divided circumapical ciliary band; apical field with bundles of sensillae; one cerebral eyespot and two lateral ocelli on short papillae in circumapical band; paired dorsal antennae; retrocerebral organ and subcerebral glands small; vitellarium spherical, riboon- or horseshoe-shaped, with eight or many nuclei; foot short or long, unsegmented, annulated or with a single distinct foot segment; toes conical, tiny or lamelliform; oviparous or viviparous.

Key to species of Asplanchnopus known from Australia

Dorsal antennae divided, widely separated; >50 pairs of protonephridial flame cells; trophi >100 µm ..... *A. multiceps* (Schrank)
Dorsal antennae partly fused; 8-13 flame cells; trophus <75 µm ..... *A. hyalinus* Harring

Asplanchnopus hyalinus Harring
FIG. 15:1

Asplanchnopus hyalinus Harring, 1913, p. 402, Fig. 32: 3-4.

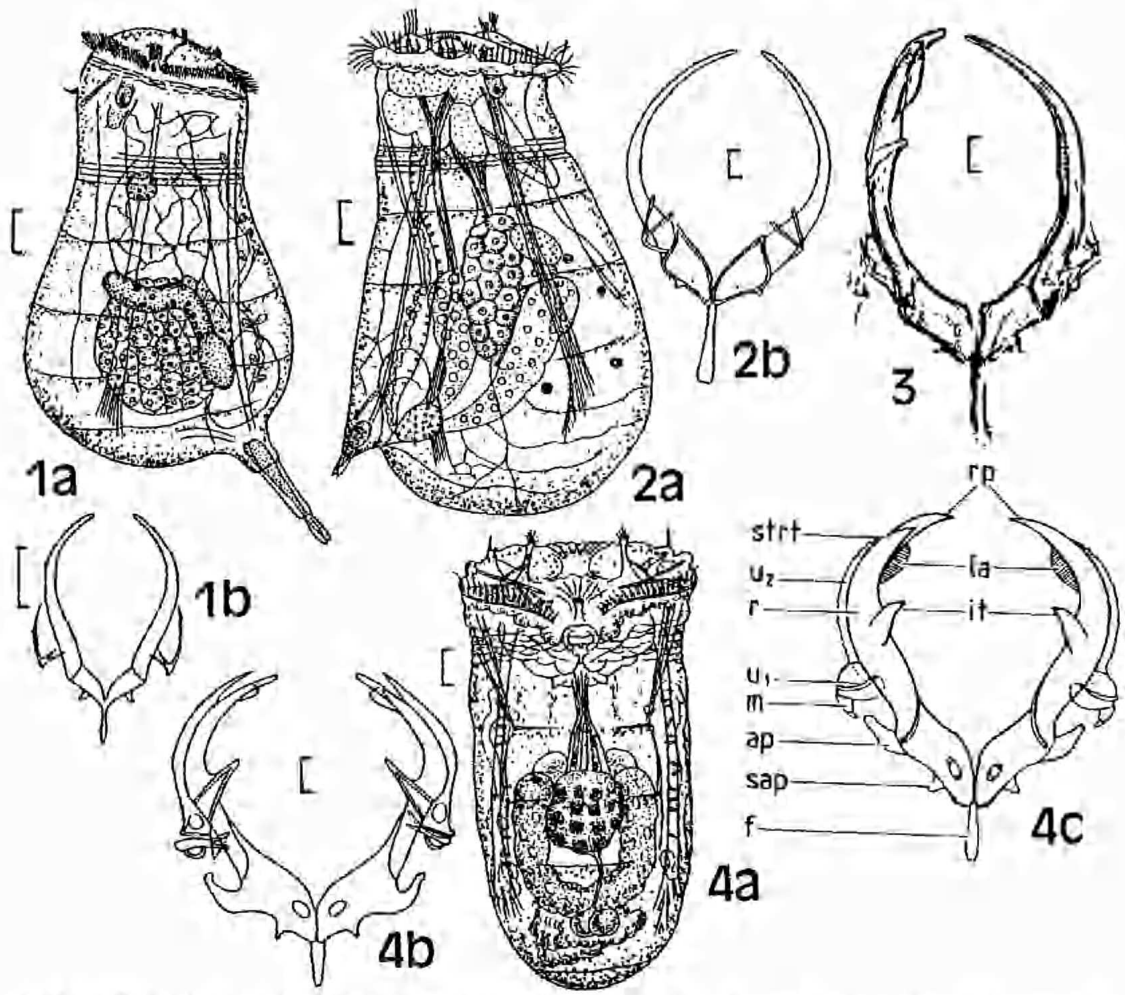


Fig. 15. 1, *Asplanchnopus hyalinus* Harring: (a) lateral; (b) trophus. 2, *A. multiceps* Schrank: (a) lateral; (b) trophus. 3, *Asplanchna asymmetrica* (Koste & Shiel), trophus. 4, *A. brightwelli* Gosse: (a) dorsal; (b) trophus; (c) trophus, diagrammatic (ap= apophysis on bulla of ramus; f= fulcrum; it= inner teeth on rami inner margins; la= lamella behind rami points; m= manubrium; r= ramus; rp= rami apices; sap= subapophysis; strt= second ramus tooth; u_1= 1st uncus; u_2= 2nd uncus). 1 after Harring (1913), 2 after Weber (1898), 3, 4c after Shiel & Koste (1985), 4a after Hudson & Gosse (1886), 4b after Hauer (1952).

Type locality: Four-mile Run, near Washington, D.C., U.S.A.

Description: Body moderately elongate, slight constriction between head and trunk; foot about one-third body length, segmented, distal joint twice as long as proximal; toes lamelliform, similar length as first foot-joint; pedal glands as long as entire foot; corona with interrupted circumapical band, ventrally at mouth and laterally by two small papillae bearing ocelli; cerebral eye present; mastax large, trophi incudate, distinguished from other species in the family by lack of inner teeth or reinforcing ribs; short oesophagus, large stomach with pair of gastric glands opening into anterior region; eight pairs of protonephridial flame cells; ovary ribbon-shaped. ?Oviparous.

BL 520-660 μm; FT 90-120 μm; T 32-40 μm; TR 63-75 μm.

Distribution. Carnivore on small rotifers (e.g. *Lecane*, *Lepadella*). Only four records, all Victoria: billabongs of Goulburn, Mitta Mitta and Murray, and Ovens R. inlet to L. Mulwala: 15.0-17 °C, pH 7.0-7.8, DO 8.0-9.8 mg l^{-1}, 65 μS cm^{-1}, 2 NTU.

Asplanchnopus multiceps Schrank
FIG. 15:2

Brachionus multiceps Schrank, 1793, p. 30, Fig. 3:16-19.
Asplanchnopus multiceps: De Guerne 1888, p. 57.

Type locality: (Germany).

Description: Saccate body, foot short, gradually merging into trunk; head margins sometimes reddish-coloured; vitellarium horseshoe-shaped with many nuclei; >50 pairs of protonephridial flame cells; large bladder; TR: rami slender, apices occasionally slightly cleft; one cerebral eye, two lateral ocelli; RE yellow-coloured, spinulate. Viviparous. Male large with remnants of digestive tract, many flame cells.

BL 445-1000 μm; male 400-500 μm; TR to 190 μm (FU 52 μm); RE 220-238 μm.

Distribution: Carnivore on other rotifers and small microcrustaceans (Koste 1987). More widespread than *A. hyalinus:* N.S.W., N.T., Qld, Vic.: 10.0-28.0 °C, pH 6.0-8.1, DO 6.9-13.0, 37-170 μS cm^{-1}, <1-24 NTU.

Asplanchna Gosse
Asplanchna Gosse, 1850, p. 18.

Body with thin transparent integument; saccate, tubular barrel- or bell-shaped, some species with lateral protrusions of the integument; corona an interrupted ciliary wreath, apical field large, more or less rounded; intestine and anus absent; ciliary bundles on relatively high papillae in apical field; one cerebral eye appended to brain; lateral antennae large, at beginning of posterior third of body; dorsal antennae paired; TR incudate, horizontal in mastax with apices facing posteriorly, everted and extruded to sieze prey; oesophagus a wide extensible crop; kidney-shaped or spherical gastric gland on oesophagus. For a review of research on *Asplanchna*, see Koste (1978a). Seven species of *Asplanchna* are recorded from Australia.

Key to species of *Asplanchna* known from Australia

1. Rami clearly asymmetric under low magnification, left ramus with median inner tooth, lamellar plate behind ramus tip, right ramus without either . . . . . *A. asymmetrica* (Shiel & Koste)
   Rami symmetric under low magnification 2
2(1). Vitellarium spherical 3
   Vitellarium ribbon-like 4
3(2). Vitellarium with up to 8 nuclei; rudimentary foot glands absent; four pairs of protonephridial flame cells . . . . . *A. priodonta* Gosse
   Vitellarium with 12-15 nuclei; footglands present; 20-40 flame cells . . . . . *A. herricki* De Guerne
4(2). Trophus without apophyses; constant 16 flame cells . . . . . *A. girodi* (De Guerne)
   Trophus with robust apophyses; 10-100 flame cells 5
5(4). Rami inner margin with distinct, large tooth 6
   Inner margin tooth absent or rudimentary . . . . . *A. intermedia* Hudson
6(4). Broad lamellae behind rami apices, which are symmetrical, acute; ca. 32 nuclei in vitellarium; 10-20 flame cells; resting egg with vesicular structure . . . . . *A. brightwelli* (Gosse)
   Lamellae absent; apices asymmetric: left bifurcate, right single; >50 nuclei in vitellarium; 40-100 flame cells; RE with pleated outer shell . . . . . *A. sieboldi* (Leydig)

Asplanchna asymmetrica Shiel & Koste comb. nov.
FIG. 15:3

Asplanchna brightwelli asymmetrica Shiel & Koste, 1985, pp. 9-11, Figs 4a, b.

Icomotype: Shiel & Koste (1985) Fig. 4a, b.
Paratypes: South Australian Museum (SAM) V3945.
Type locality: Solomon Dam, Palm Island, Qld.

Description: Body saccate; horseshoe-shaped vitellarium; TR asymmetrical: left ramus with short medial inner tooth, subterminal lamella and second uncus as in *A. brightwelli*, right ramus with none of these, more tapered and arched than that of *A. brightwelli*.

BL <500 μm; TR 130 μm.

Distribution: Carnivore/?omnivore in plankton of shallow waters. Collected in flooded Barmah Forest (by Kanella Fisheries staff) with *Trichocerca* trophi in gut. Rare, but probably more widely-distributed than limited records indicate. Known from Qld., Tas., Vic. W.A. 19.7 °C, pH 7.3, 39 μS cm^{-1}, 2.1 NTU. May co-occur with *A. sieboldi*, markedly smaller than congener.

Comment: A. asymmetrica is readily separated from *A. brightwelli* on trophus structure alone, and trophus morphology is constant between widely separated populations. We consider *A. asymmetrica* specifically distinct from *A. brightwelli*.

Asplanchna brightwelli Gosse
FIGS 15:4, 16:b, 17:1,2

Asplanchna brightwelli Gosse, 1850, p. 23.

Type locality: (U.K.).
Description: Body usually saccate, some protrusions recorded by Gilbert (1973); TR: single small hollow tooth on scapus (distal inner ramus margin) (Fig. 17:1, 3); symmetrical squared-off lamellae behind tips of rami (Fig. 16b, 17:2); vitellarium with 21-33 nuclei; RE with semi-spherical lobes on surface. See Gilbert *et al.* 1979 for further details.

BL 500-1500 μm; Male 160-500 μm; RE 146-180 μm.
Distribution: Widely distributed on mainland Australia, not recorded from Tasmania. May be more widespread, likely to be confused with *A. sieboldi*. 9.1-26.0 °C, pH 7.0-8.3, DO 3.1-12.5 mg l^{-1}, 95-1000 μS cm^{-1}, <1-110 NTU.

Asplanchna girodi De Guerne
FIG. 18:1

Asplanchna girodi De Guerne, 1888, p. 54, Fig. 8.

Type locality: Azores.
Description: Repeatedly confused with *A. brightwelli;* body always saccate; outline of closed trophus somewhat rectangular; scapus usually without tooth, although some populations have been recorded with small teeth (Koste 1978a); apophysis rudiments also are known; male resembles that of *A. brightwelli*; RE covered with tightly-packed vesicles in a honeycomb pattern.

BL 500-700 μm; TR 93 μm; Male 250-397 μm.
Distribution: In plankton and littoral of pools, may be sympatric with *A. brightwelli*. Also in athallassic saline waters (Europe). Rare in L. Burley Griffin, ACT, R. Murray billabongs, and a single site near L. Wayatinah, Tas (Koste *et al.* 1988). 9.0-17 °C, pH 6.1-7.6, DO 10 mg l^{-1}, 65-203 μS cm^{-1}, 92 NTU.

Asplanchna herricki De Guerne
FIG. 18:2

Asplanchna herricki De Guerne, 1888, p. 52, Fig. 6.

Type locality: Azores.
Description: Body saccate; size and shape of both sexes

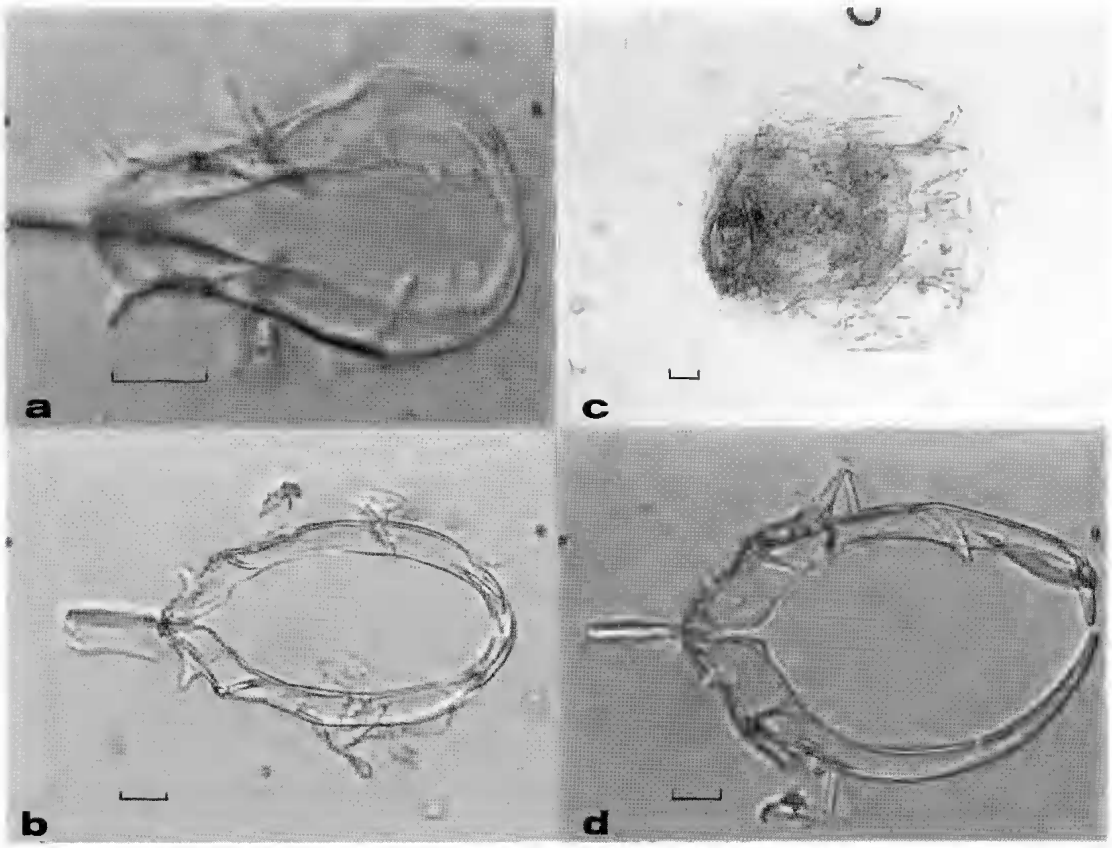


Fig. 16: a, *Asplanchna priodonta* Gosse, trophus. b, *A. brightwelli* Gosse, trophus. c, *A. symmetrica* Shiel & Koste, contracted, with *Keratella* prey in gut. d, trophus. Sony CVP G-700 video prints. Scale bars: 50μm adult; 10μm trophi.

resemble *A. priodonta*. Paired foot gland rudiments present; double projection at opening of secretory canal from them; 12-50 flame cells; TR: distinctive spatulate ramus; variability in size and shape of numerous inner rami teeth and presence or absence of unci; fulcrum short; rami tripartite, segmented by fillets; between upper and middle part, a large rounded lamella; manubria long, forklike rods; RE fully covered with vesicles.

BL 500-2000 μm; TR 110-120 μm; male 200-350 μm.

Distribution: Pelagic in oligotrophic pools and mesotrophic lakes in Europe and N. America. Reported by Evans (1951) from Albert Park, Vic. and a single record in our collections (08.X.81) from a shallow creek draining L. Muir, W.A. 15.5°C, 3500 μS cm^{-1}.

Asplanchna intermedia Hudson
FIG. 18:3

Asplanchna intermedia Hudson, in Hudson & Gosse, 1886, p. 122.

Type locality: (U.K.)

Description: Saccate or polymorphic body; vitellarium with 44-48 nuclei; TR: generally slender morphology;

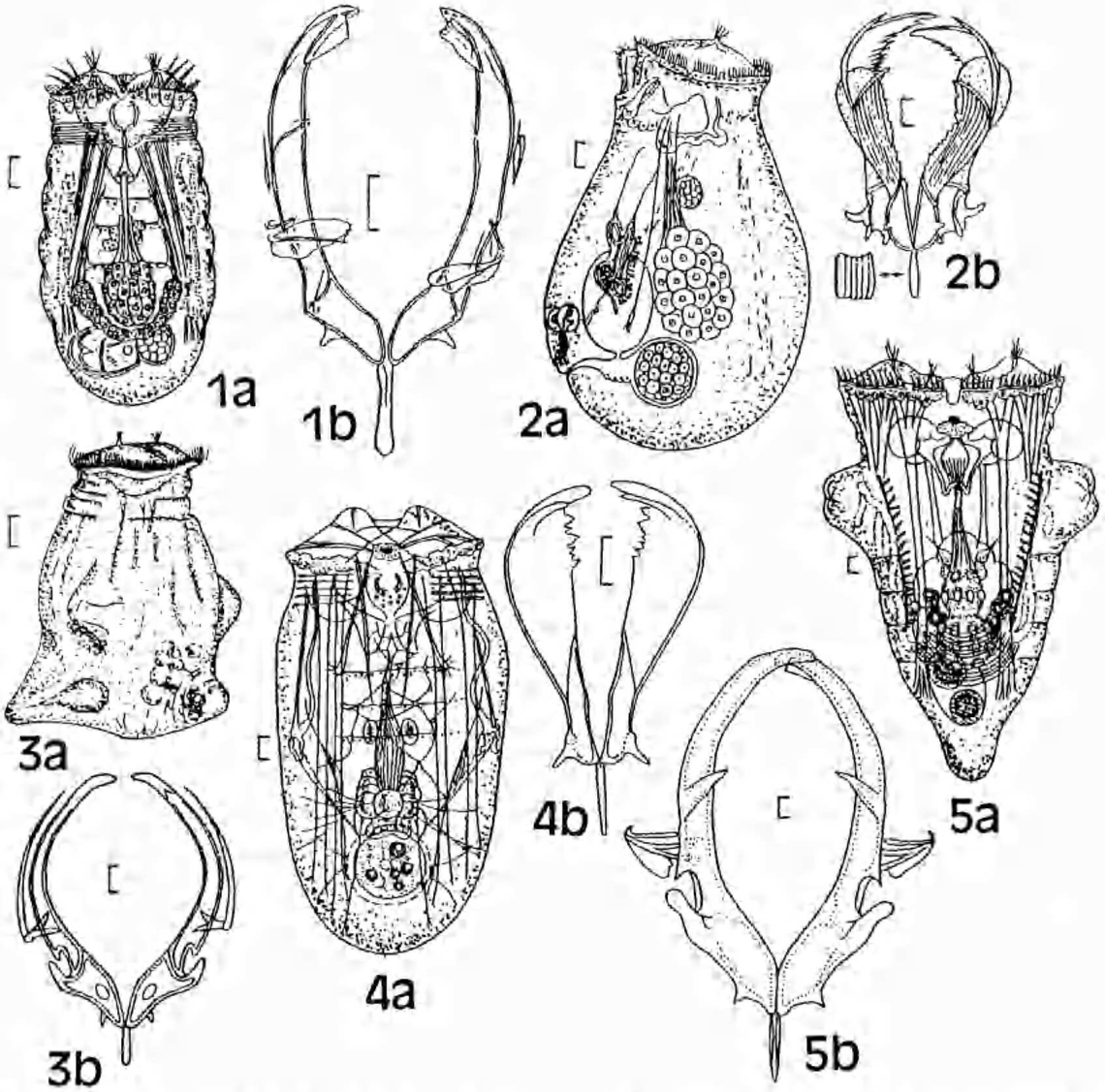


Fig. 17: 1, *Asplanchna girodi* (De Guerne): (a) dorsal; (b) trophus. 2, *A. herricki* De Guerne: (a) dorsal; (b) trophus, lateral view of fulcrum on left. 3, *A. intermedia* Hudson (a) dorsal; (b) trophus. 4, *A. priodonta* Gosse: (a) dorsal; (b) trophus. 5, *A. sieboldi* (Leydig): (a) dorsal; (b) trophus. 1a after Wang (1961), 1b after De Beauchamp (1951), 2 after Wulfert (1961), 4a, 5a after Hudson & Gosse (1886), 4b after Hauer (1952), 5b after Hauer (1937). Scale bars: adults 50 μm, trophi 10 μm

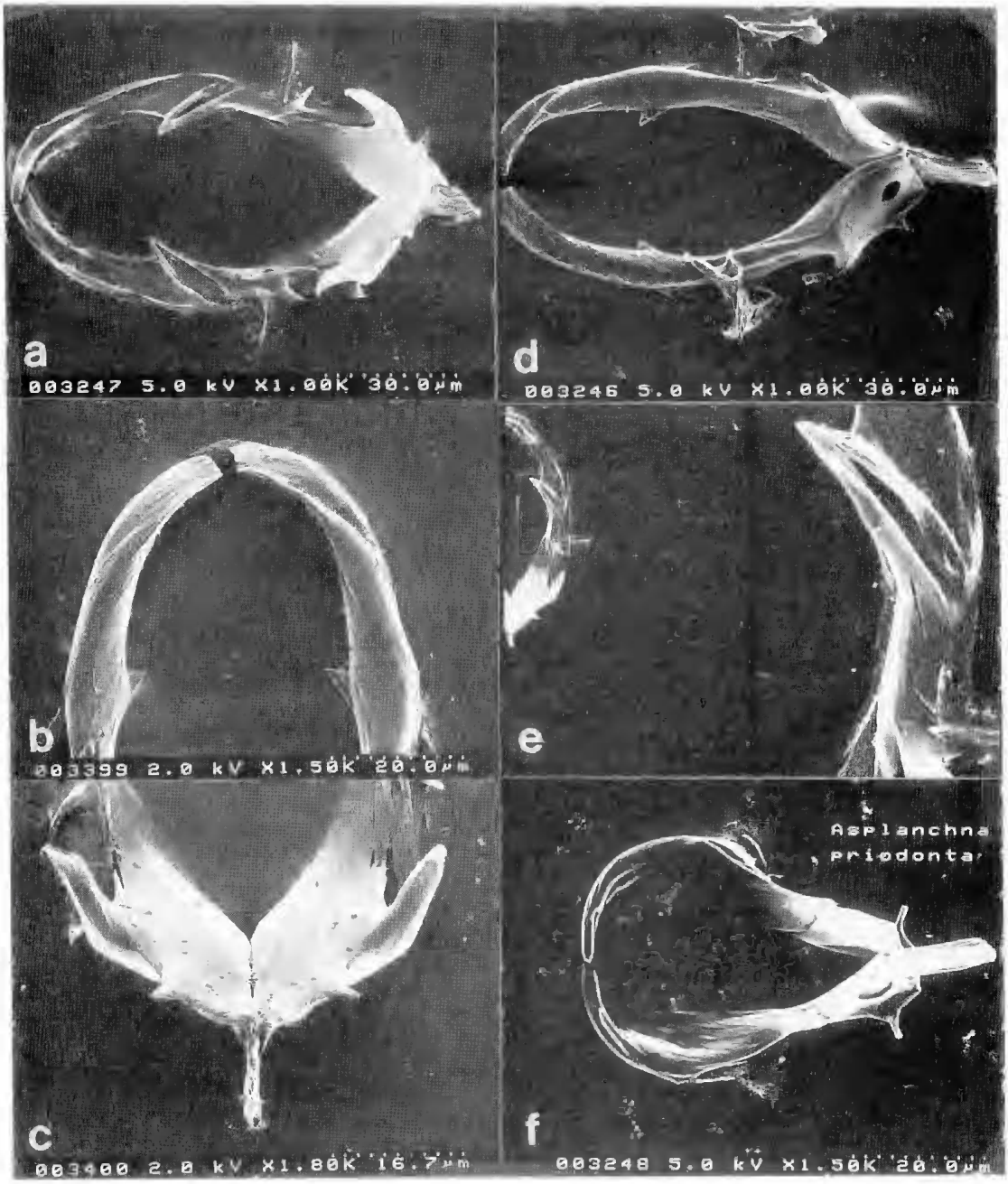


Fig. 18. 1, *Asplanchna brightwelli* Gosse: trophus, ventral. 2, trophus, dorsal. 3, detail of tooth on inner ramus. 4, *A. priodonta* Gosse: trophus, dorsal. Scanning electron micrographs, Kodak T-Max, Hitachi SEM, University of Waikato, Hamilton, N.Z.

rami tips resemble those of *A. sieboldi*, albeit less robust and less noticeable bifurcate; well-developed apophyses; rami not lamellate, and no inner tooth on scapus; RE with anastomosing ridges.

BL 580-900 μm; TR 104-156 μm; male 290-439 μm, RE 136 μm.

Distribution: In pelagial of ponds and lakes (Europe). Single early record from Qld (Colledge 1914). Not seen in our samples, needs verification.

Comment: Some similarities with *A. brightwelli* (apophyses on the rami) and *A. girodi* (absent or reduced scapus teeth), however the specific distinction of this taxon was verified by the study of Gilbert *et al.* (1979).

Asplanchna priodonta Gosse
FIGS 16a, 17:4, 18:4

Asplanchna priodonta Gosse, 1850, p. 18, Figs 1, 2

Type locality: Hyde Park, U.K.

Description. Body rounded to saccate, often with a single hump on one side at the posterior; TR: distinctive spatulate proximal rami, with denticulate inner tip (Fig. 16a, 18:4b); no tooth on scapus; rami external margins from hemispherical curve, tapering to small, projecting (almost right angled) subapophysis; RE reported to be smooth-shelled.

BL 250-1500 μm; male 200-500 μm; Tr 60-80 μm; RE 127-150 μm.

Distribution: Cosmopolitan, perennial in oligotrophic lakes, also in brackish water (Europe). Reasonably common in billabongs, reservoirs and rivers of eastern mainland Australia, not recorded from Tasmania, N.T. or W.A. 7.9-27.0°C, pH 7.4-8.2, DO 8.6-12.5 mg l^{-1}, 46-850 μS cm^{-1}, <1-120 NTU.

Asplanchna sieboldi (Leydig)
FIG. 18:5

Notommata sieboldi Leydig, 1854, p. 24, Fig. 2: 15-17.
Asplanchna sieboldi: Eyferth 1878, p. 94.

Type locality: (Germany).

Description: Resembles *A. brightwelli*, commonly larger. Transitional forms are recorded (Koste 1978). Variable morphology: saccate, cruciform or bell-shaped. TR: superficially similar to those of *A. brightwelli*, but lacking lamellae, and asymmetric (left ramus bifurcate, right single with the tip fitting between the left apices when closed). Vitellarium with 55-96 nuclei. RE covered with elevated concave discs. Male corresponds to female in morphological variability.

BL 500-2500 μm; male 300-1200 μm; TR 80-90 μm (Europe), 220-340 μm (Murray-Darling billabong populations, Koste & Shiel (1980)); RE ca. 200 μm.

Distribution: Cosmopolitan warm stenotherm, most common *Asplanchna* in our collections, not yet recorded from W.A. May be the largest planktonic carnivore in pelagic communities, particularly in billabongs, where it preys on other rotifers and small microcrustaceans. 7.0-25.3°C, pH 6.9-8.5, DO 1.7-11.3 mg l^{-1}, 27-1100 μS cm^{-1}, <1-50 NTU.

Comment: There has been considerable confusion in the literature between *A. sieboldi* and *A. brightwelli*, despite the clarification by Gilbert *et al.* (1979). The two taxa are readily separated on trophi structure, also by vitellarium nuclei number.

Biogeography

To date we have accumulated some 5000 microfaunal samples from scattered parts of mainland Australia and Tasmania. The area covered probably represents less than a fraction of 1% of the continent. Virtually every sample series we examine contains new species or new records (cf. Storey *et al.* 1993). Comments on biogeography thus are still preliminary and reflect the small number of collectors.

At the completion of this series we will have reviewed more than 664 rotifer taxa presently known from the continent (515 Monogononta, 84 Digononta and 66 subspecies or infrasubspecific variants). We suspect that this represents less than half, possibly less than a third, of the Rotifera which ultimately will be found here. Of these, 60 taxa (10%) at the species level are known only from Australia, with a further approx. 5% of taxa at subspecies or 'varietal' resolution apparently indigenous. Some of these will be resolved in the on-going global revision, e.g. at least two subspecific or unresolved taxa from our earlier papers have been elevated to specific rank by revisers (Segers, in press; De Smet, in press).

Conversely, some taxa we thought to be endemic to Australia have been found recently in New Zealand (Sanoamuang & Stout 1993) and another, *Lepadella williamsi* Koste & Shiel, 1980, was declared a synonym of *L. vandenbrandei* Gillard, 1952 by Segers (1993). In any event, the level of endemicity of the Australian Rotifera lies somewhere between 10-15% at present the highest proportion for any continent on present information.

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